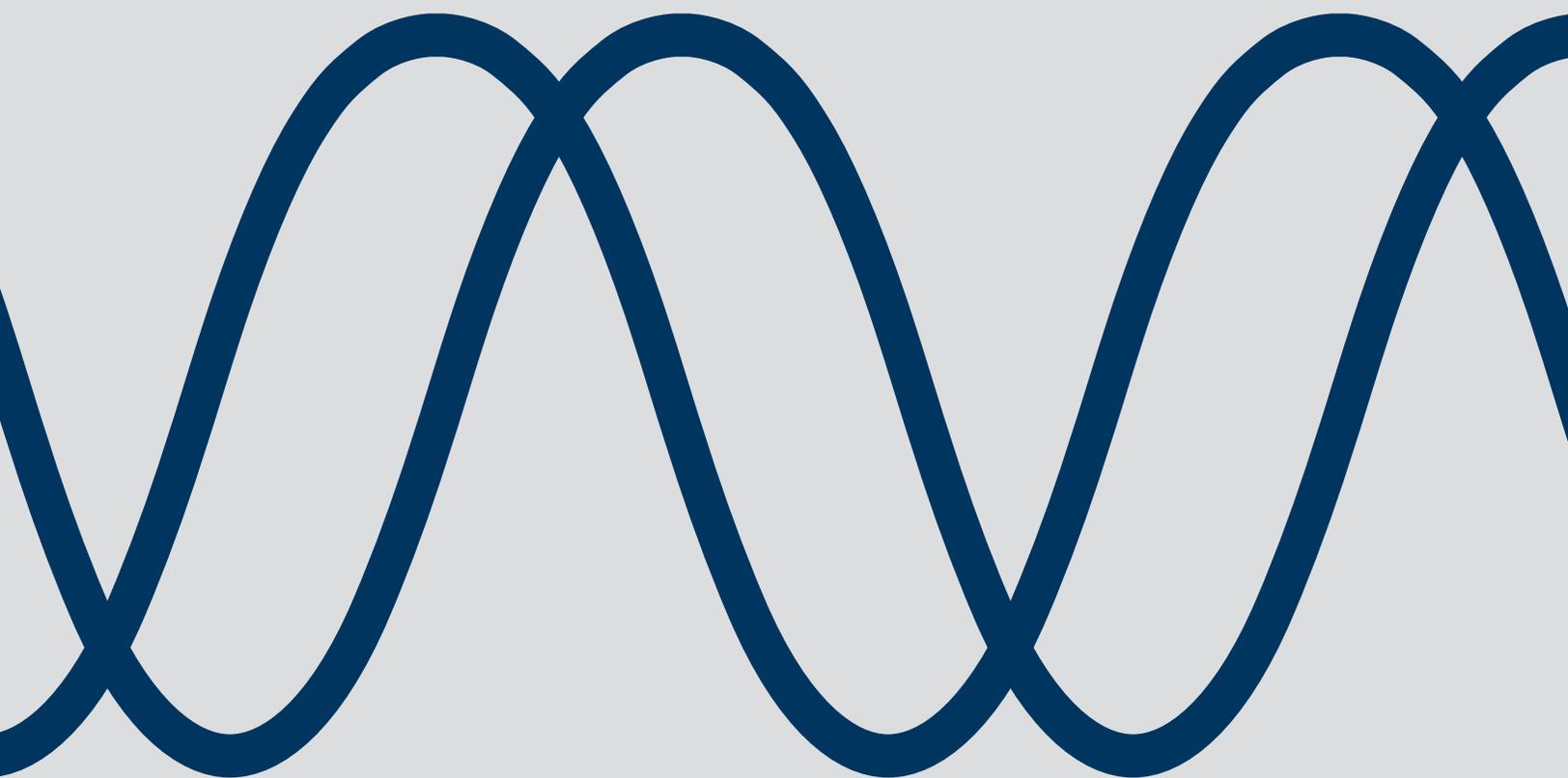


LEINE  LINDE



ADS Uptime 800

MANUAL / USERS GUIDE

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LEINE  LINDE

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1 General information

Thank you for choosing this device produced by the Swedish encoder manufacturer Leine Linde. In your hands, you have a state-of-the-art component that is ready to be used in the utmost demanding environments. This manual describes the installation procedure and use of encoders with ADS Uptime™, the advanced encoder diagnostic system by Leine Linde. If you are in need of assistance during the system design phase, commissioning or during operation, please make sure that you contact your local Leine Linde representative.

1.1 Applicability of manual

This manual is divided into two sections, the first applies to usage of the ADS Uptime encoders via wireless communication and the Leine Linde developed ADS Uptime app. The second applies to integration of the ADS Uptime functionality via OPCUA by use of the ADS Link.

Encoder series featuring the wireless functionality of ADS Uptime are listed below.

XSI 850
XHI 861
XHI 862

For encoders of model MRH 28xx please refer to specific manual available at <https://www.leinelinde.com/support/downloads/> under the 'manuals' section.

1.2 About Leine Linde

Leine Linde is a Swedish company with international presence. For more than 50 years, Leine Linde has developed and manufactured advanced encoders that meet the most rigorous demands a user can place on them. That is why a wide assortment of incremental and absolute encoders with focus on robust products and quality down to the last detail can be offered. Leine Linde encoders provide the utmost in reliability year after year, in working conditions where vibration, dirt, cold and other harsh environments are common.

Leine Linde can meet very specific individual demands. Due to a modular design in the collection, the encoders are easily adapted exactly to the customer's needs with respect to resolution, electrical connections, interfaces, encapsulation and functionality. Leine Linde concentrates on advanced development of intelligent encoder solutions with integrated ASICs, new special features and with adaptations to different fieldbus systems. Thereby the company can meet the need for increasingly effective and dependable machines and automation to an even higher degree.

1.2.1 Technical and commercial support

Leine Linde is represented by local offices and subsidiaries in many countries around the world. In addition, there are many services agencies and distributors located worldwide ready to reply to commercial enquiries or technical support. For more contact information, please visit our website or contact Leine Linde in Strängnäs, Sweden.

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1.3 Encoder with integrated diagnostics

An incremental encoder from Leine Linde always has the basic function of giving electrical pulses with a frequency related to the rotational speed of a shaft. An encoder equipped with ADS Uptime has an additional integrated diagnostic system, separate from this basic function, which constantly monitors that the basic function is operating correctly.

The functionality of ADS Uptime can be summarized in the following points:

- A diagnostic system that constantly monitors the encoder's key functions, fully integrated into each encoder.
- The automatic fault interpretation determines the seriousness of the fault and categorizes it into various status levels. You will receive a warning immediately when an impending fault is detected.
- Monitoring of ambient environmental parameters ensures that the encoder is not subjected to detrimental conditions.
- The environmental monitoring may also be used to increase user awareness about the ambient environmental condition surrounding the encoder.
- Continuous storage of detailed operational data in the encoders memory makes it possible to analyse trends for vibration, temperature and other parameters.
- The associated app for Android or iOS has the capability to set custom warning levels and conduct graphical analysis of the environmental parameters during operation or offline.
- Data from the ADS Uptime encoder can be integrated into other systems, platform-independently and with two-way communication, via OPC-UA, when it is used together with an external ADS Link unit.

2 Functionality: diagnostics and data acquisition

ADS Uptime is a diagnostics system monitoring the encoder's key functions, but also a system for acquisition of data from the surrounding environment through a number of sensors. Each encoder has an integrated memory where detailed data of the encoder's operating history is stored.

The system has preset alarm levels for working environment which are potentially harmful for the encoder, as well as a customer configurable warning system to adapt the diagnostic system to application specific parameters.

2.1 Constant function monitoring

The advanced diagnostics system continuously checks and verifies the encoder's basic functionality. Diagnostics are performed for functions like pulse detection, output signal quality and optics. A detailed list of monitored functions can be found in Appendix A.

Pulse detection

- Resolution error
- Reference pulse not detected
- State transition fault

Optics

- Light unit current
- Light source failure

Output signals

- Faulty output signal
- Low signal level

2.2 Monitoring of ambient environmental parameters

With ADS Uptime, the encoder's function is expanded to encompass several sensors in one. This multi-sensor constantly reads off the levels for several environmental parameters in its surroundings.

- Vibration radial (resultant of x and y axis)
- Vibration axial (z axis)
- Humidity
- Shaft speed
- Frequency
- Temperature
- Supply voltage

It also keeps track of the following values accumulated by the actual encoder unit.

- Revolutions (total number generated)
- Time powered
- Time in motion

A detailed description of the ambient parameters and accumulated values can be found in Appendix B.

2.2.1 Preset warnings for harmful ambient environment

If an environmental parameter reaches levels that are damaging to the encoder, a warning is sent via all available channels. A warning means that the encoder is still functional, but that it is subjected to an environment that may damage it. If actual damage should occur in the encoder, the warning changes to a higher alarm level. But if measures are taken in time so that the environment parameters return to an acceptable level, the warning can be dismissed.

2.2.2 Set custom warning levels adapted to your machine

The encoder's ambient environment can be harmful even for other components nearby. ADS Uptime therefore offers the opportunity to program custom warning levels for the environmental parameters that are to be monitored. With this function, you can set levels that are adapted to the limitations on your particular machine, and avoid the risk of prematurely wearing out components. This can be made in your ADS Uptime app or in the OPC-UA compatible system of your choice (if connected via the ADS link).

2.3 Encoder status

An important function in ADS Uptime is that the system conducts automatic interpretation and analysis of each detected fault. The analysis determines the seriousness of the fault and sorts it into one of the below categories based on the encoder's condition. The system also provides notification of a recommended measure that should be taken to prevent problems.

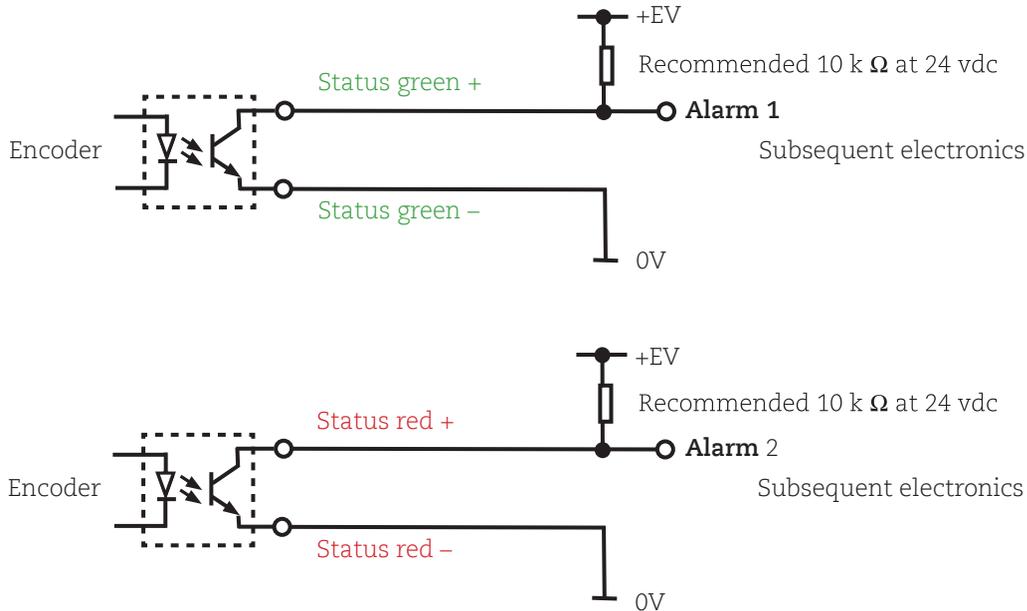
For proper functionality of signals Status 1+, and status 2+, they need to be connected to an input with a pull-up resistor, see "Figure 1 Circuits for status wires".

Every time a fault is detected the status 1+ and status 2+ wires will be grounded in a certain pattern which should be interpreted according to table 1. It is important to note that the Status 1+ and status 2+ depend on an external voltage and do not themselves output a signal.

Status	Encoder status LED	Electrical Wire, Status 1+	Wire, Status 2+
Normal state	Steady green	0	1
Warning	Steady orange	0/1 (togglng)	1
Serious alarm	Flashing red	1	0/1 (togglng)
Critical alarm	Steady red	1	0
Not powered	Off	1	1

Table 1 Encoder LED and electrical wire status indication (1=+E Volt, 0=0 Volt)

If ADS Uptime detects an alarm or warning in the encoder, the status will change and an electrical fault indication will be sent via the signal cable. To enable this function, the connection must be made in the following way.



The LED status signifies the following condition:

- Steady green – Normal state, full functionality.
- Steady orange – Warning, risk for fault due to harmful ambient environment. Recommendation to check the installation and correct deficiencies.
- Flashing red – Serious alarm, impending fault. If the alarm returns after being acknowledged, replacement of the encoder is recommended during the next shutdown for service.
- Steady red – Critical alarm, inoperable. Immediate replacement of the encoder is necessary.

Note: Some false warnings and/or alarms may occur as a result of improper handling of the encoder during maintenance or commissioning. If a warning or error occurs in direct relation to commissioning or maintenance, please first attempt to acknowledge these alarms.

When the encoder is connected to the ADS Uptime app detailed information is available about each detected fault, along with data about the conditions of the surrounding environment at the time when the fault occurred. When the encoder is connected via ADS Link, the data from the encoder is processed in accordance with the programming of the OPCUA compatible system of your choice.

3. ADS Uptime wireless (Bluetooth)

3.1 Connection interface

The ADS Uptime diagnostics data and configuration can be accessed via Bluetooth, BLE 4.1. The Bluetooth has a range of approximately 20 meters but the total range is influenced by environment and obstacles.

When an active Bluetooth connection is established with the encoder, the Bluetooth LED on the encoder will be blue. Not more than one Bluetooth connection can be active with an encoder at a time.

3.1.1 Start-up of the encoder diagnostics system

Every time power is supplied to the encoder the diagnostics system has a start-up time of approximately two minutes. During this time the encoder LED is flashing green with a high frequency. Once the LED stabilizes on one of the four status levels (steady green, steady orange, flashing red, steady red) the diagnostics system is functional.

Note that the encoder's basic function (incremental pulses) is up and running also during the start-up time of the diagnostics system.

3.2 Using the ADS Uptime app

This manual will be up to date with the latest release of the ADS Uptime App. If unsure of your current version, visit App Store/Play Store to retrieve the latest version.

3.2.1 Download and initial set-up of the app

To download the associated application program to your mobile device, please enter the iOS App Store or the Android Google Play Store, and search for "ADS Uptime" by Leine Linde.

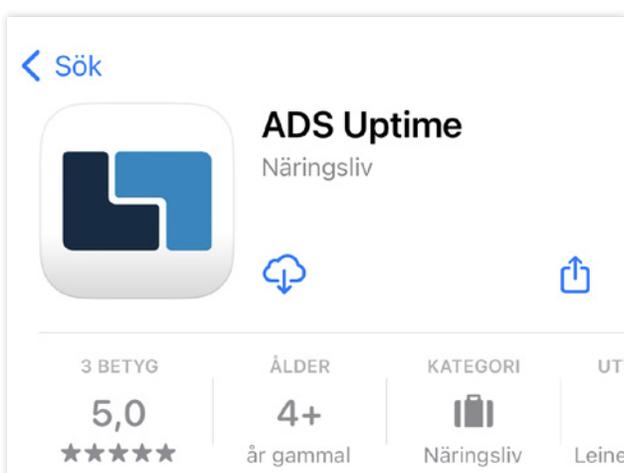


Figure 1 Find and download the ADS Uptime app

The App requires that the use of Bluetooth is approved and that Bluetooth is enabled on the device. For Android users it is also important to allow the ADS Uptime app to use the location services.

In the Settings view, global settings on the mobile device can be changed and stored. The first time you open the app, it is a good idea to go through the basic settings as this will save time later. The Settings view is reached by the settings icon, see figure 2, located in the top right corner of the screen. By pressing the global settings headline in the Settings view, these settings are changed and stored on the mobile device.



Figure 2 Settings icon

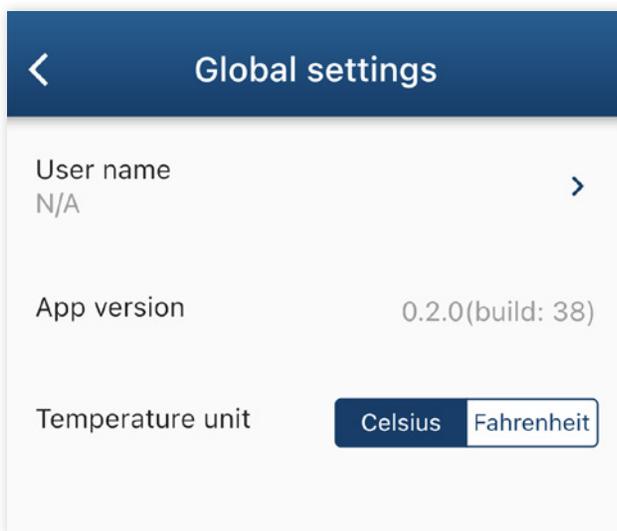


Figure 3 Global settings

Set your user name in the Global settings in the app. After setting your user name, the user name will be visible when using functions within the app. The temperature units can also be adjusted. Choose your preferred unit between Celsius and Fahrenheit.

3.2.2 Connect

Make sure that your devices Bluetooth communication is enabled before starting the app the first time. If Bluetooth is disabled or lost during the use of the app, no encoders will show up from the Bluetooth scan or the communication will be lost. Once the Bluetooth communication is established, this will be indicated on the encoders LED showing a blue light.

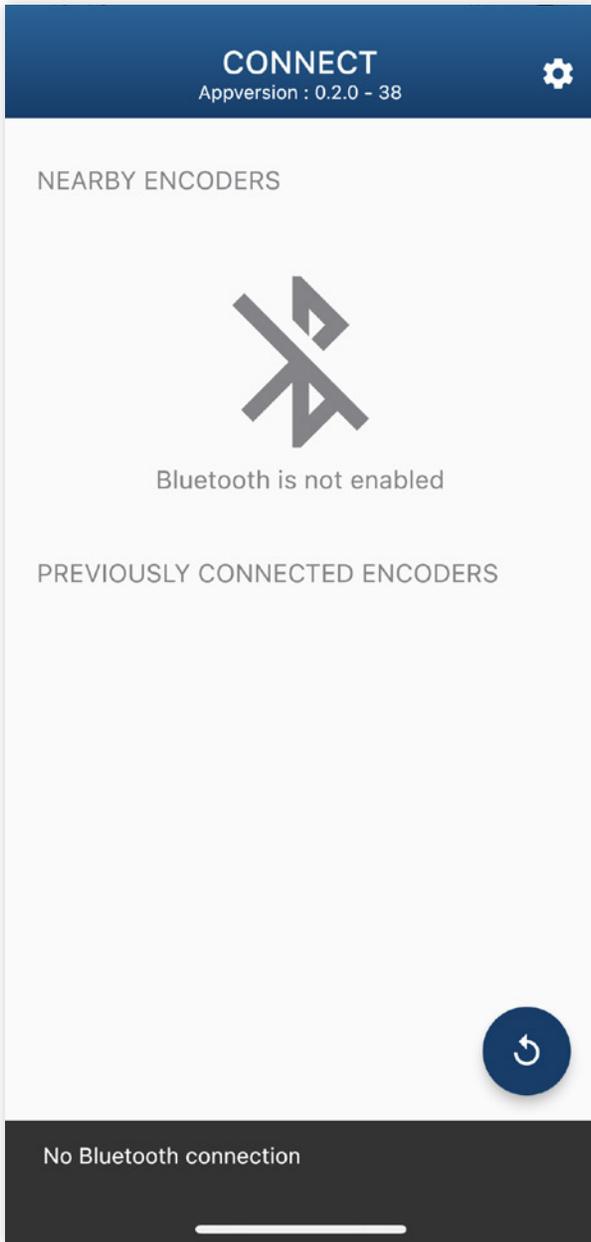


Figure 4 Ensure that Bluetooth is enabled

When starting the app all nearby encoders will be listed. Also previously connected encoders are listed. Selecting one previously connected encoder gives offline access to all data downloaded for the device.

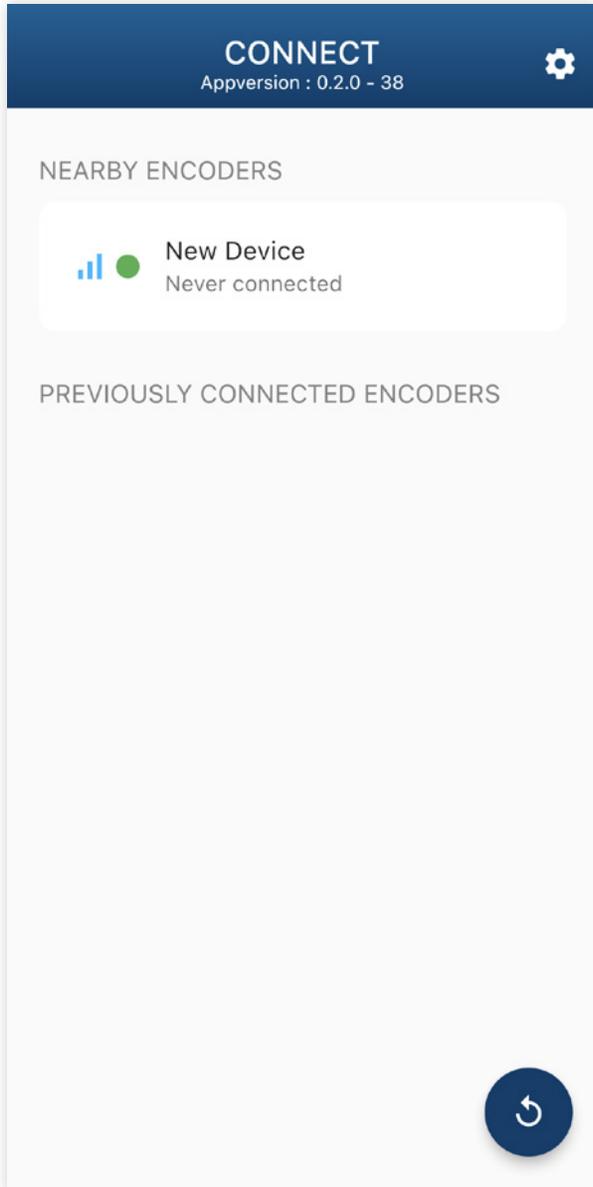


Figure 5 Start view

If the mobile device cannot find the relevant encoder, try walking for a few steps and then make a new search by using the circle arrow symbol in the bottom right corner of the start view



Figure 6 Circular arrow symbol to rescan for encoders.

3.2.3 Log in to the encoder

To log in to the encoder, click on the preferred encoder from the list of encoders within range

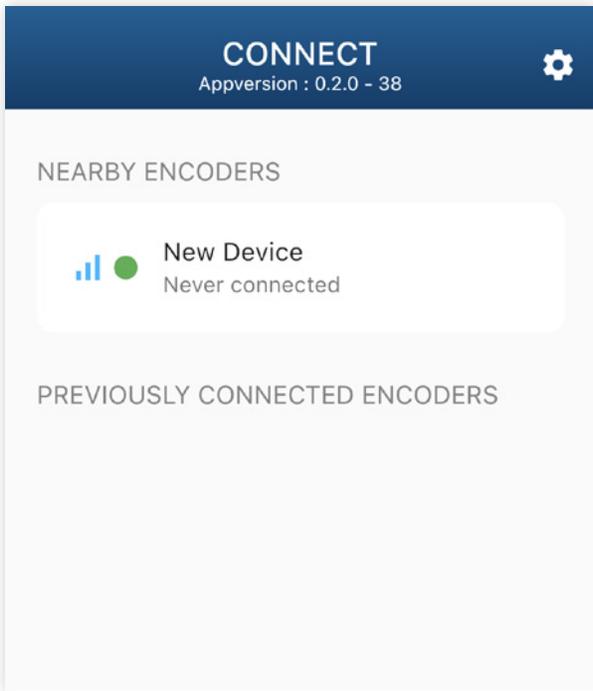


Figure 7 Encoder login

A login window will open. Choose your access type.

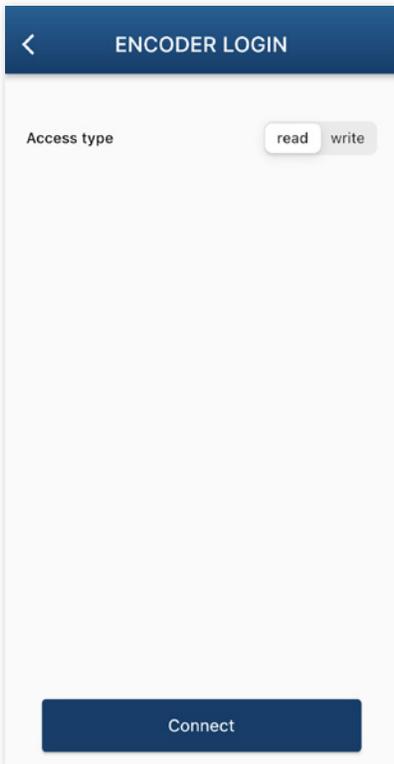


Figure 8 Access type

There are two different access types:

- Read access – Can read content from the encoder but not make any changes. This option does not require a password.
- Write access – Can read content, acknowledge warnings and make changes or adjustments to the settings.

When you login with Write access, a password is required. The password is the same as the serial number that can be found on the encoder label. This is made to ensure that you log into the intended encoder, and will also prevent login attempts from anyone outside of the premises.

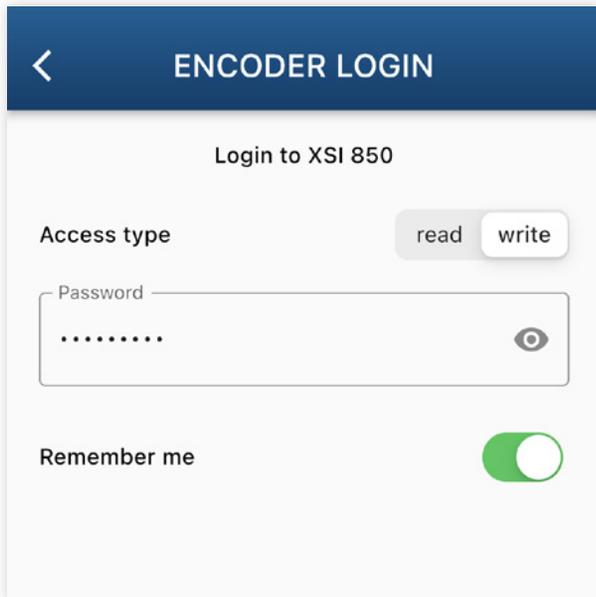


Figure 9 Write access

Click on the eye in the password field to make the password visible and readable.

Click on “Remember me” to save the password so the login process will be automatic when connecting to the encoder next time.

3.2.4 Settings view

The Settings view is divided into four parts:

- Encoder details – shows information about the connected encoder
- Alarm settings – user settings for customized alarm levels
- Firmware update – update of encoder firmware
- Global settings – permits change of units on the mobile device

It is advised to log out after setting the initial warning levels of each product. This permits logging into the encoder without write permissions for subsequent check-ups.

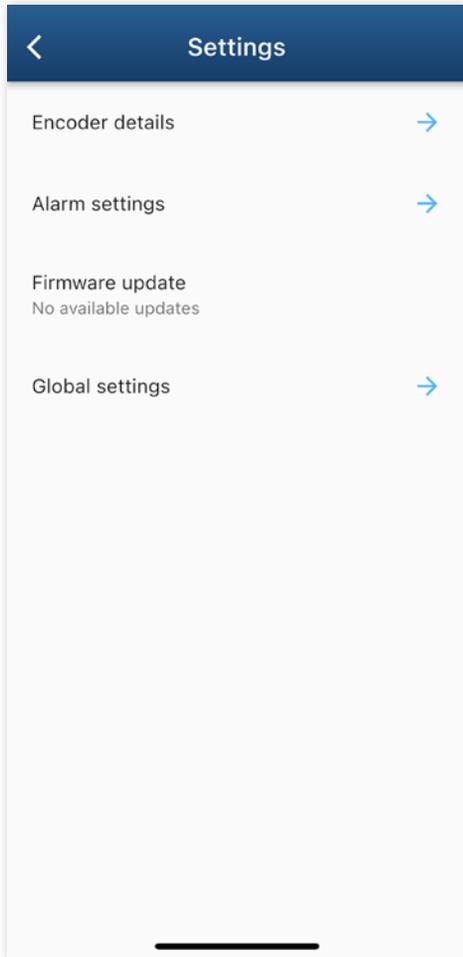


Figure 10 Settings view

3.2.5 Encoder details

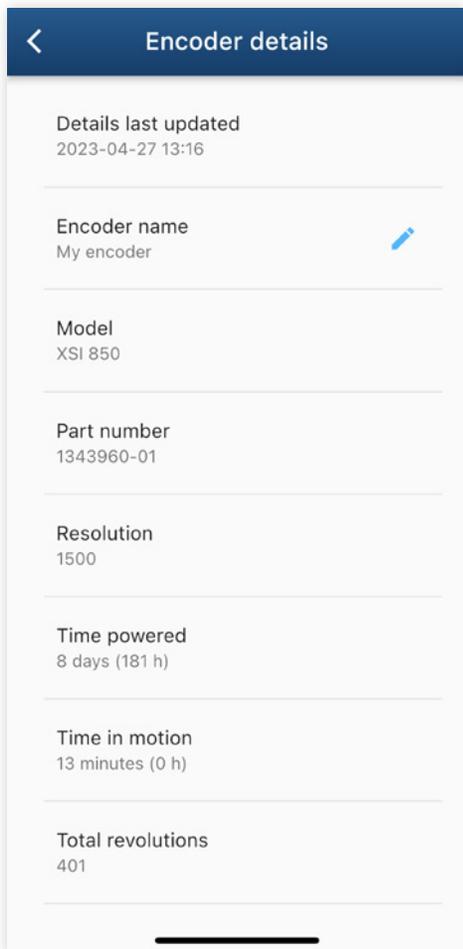


Figure 11 Encoder details

- Details last updated – Time for the last update of the encoder details
- Encoder name - The name of the encoder can be changed, for example to indicate the location of the machine where the encoder is installed. To choose a name for the encoder unit, press on the arrow and type in a new name.
- Serial number - The serial number is unique for each produced encoder. This is the way to tell one unit from another. The serial number is written on the label of the Leine Linde encoder.
- Model - The general model description for the encoder is stated in the Encoder details list. Please note that encoders from the same model can still be of many different variants, because of their modularity. This means that two encoders with the same model descriptions still may be different when it comes to output signals, cable glands or connections, etc.
- Part number - The part number defines the exact variant of the encoder, including output signals, cable glands or connections, etc, and can be used when ordering a new encoder with the same configuration.
- Resolution - The resolution is the number of pulses the encoder gives within one revolution.
- Time powered - Time powered is the number of hours that the encoder has been powered on since it was first taken in use.
- Time in motion - Time in motion is the number of hours that the encoder shaft has been rotating since the encoder was first taken in use.

- Revolutions - Revolutions states the accumulated number of revolutions during the encoder's total lifetime.
- Manufacturing date - The manufacturing date is set in the factory when the encoder is produced.
- Commissioning date - The commissioning date is automatically set the first time the encoder is powered on (outside the Leine Linde factory).

3.2.6 Alarm settings

In addition to the configurable alarm settings, the maximum and minimum values of the sliders will always trigger a manufacturer alarm. This is true whether the configurable alarm is activated or not. These values signify the extremes of the acceptable working range of the encoder.

Slide the bar to set a new value or tap on "Current settings". When the desired value is set, tap "Save", to acknowledge.

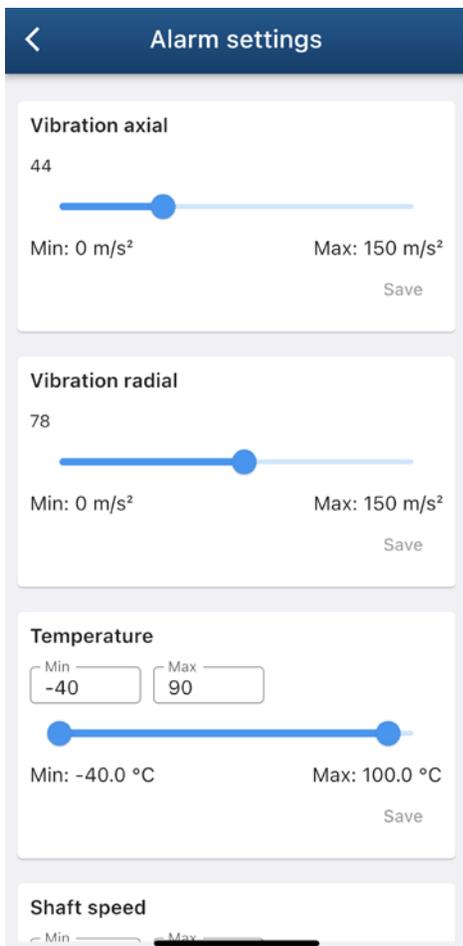


Figure 12 Alarm settings view

3.2.7 Troubleshooting the wireless encoder connection

To access the diagnostics system of the encoder, connect to the encoder from within the ADS Uptime app, see chapter 4.2, ADS Uptime app. If problems occur when trying to establish a direct connection to the encoder from the app, one of the following actions may help.

- Make sure the encoder does not already have an established connection with another device. If a connection is established, the Bluetooth LED is on.

- If the mobile device cannot find the relevant encoder, try walking for a few steps and then make a new search by using the circle arrow symbol in the top left corner of the start



Figure 13 Circular arrow symbol to rescan for encoders

- Restart the Bluetooth connection on your mobile device.
- Restart the ADS Uptime mobile app.
- Restart the encoder by disconnecting and reconnecting the power (wait one minute for the diagnostics system to boot).

3.2.8 Encoder status

In the Encoder status tab you find the live parameters from the encoder status. All values have an updating frequency of 1 Hz.

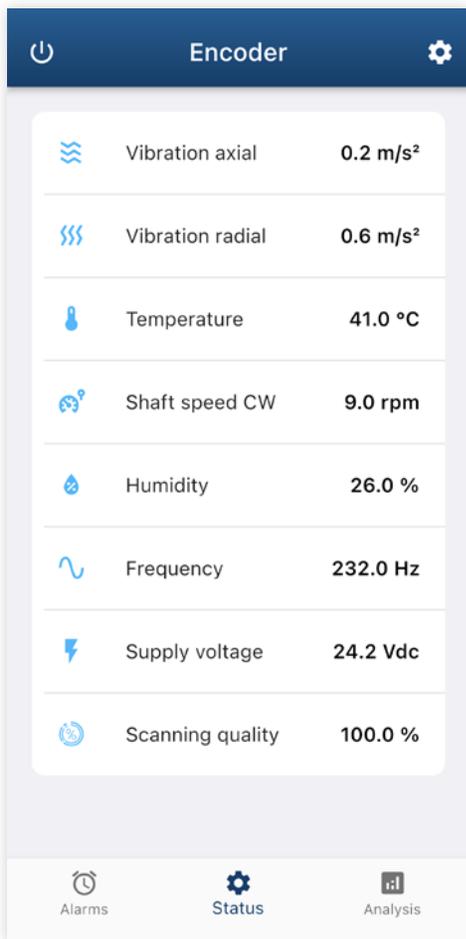


Figure 14 Encoder live parameters

- Vibration Axial – RMS value of the current vibration in axial direction
- Vibration Radial – RMS value of the current vibration in radial direction
- Temperature – temperature inside of the encoder on the PCB (Measuring units can be adjusted under “Global settings”)
- Shaft speed – rotating speed of the shaft the encoder is attached to
- Humidity – relative humidity inside the encoder
- Frequency – frequency of the incremental signal output
- Supply voltage – voltage supply measured at encoder side.
- Scanning quality – encoder signal quality

For more details on each value, please see Appendix B.

3.2.9 Attention bar

In a case of an event you will get a notification in the attention bar. After the files have been generated, click on the event to open the Analysis details page to get detailed information about the event. Swipe down to update the page. Note that it can take up to 5-7 minutes before the files has been generated.

Event examples:

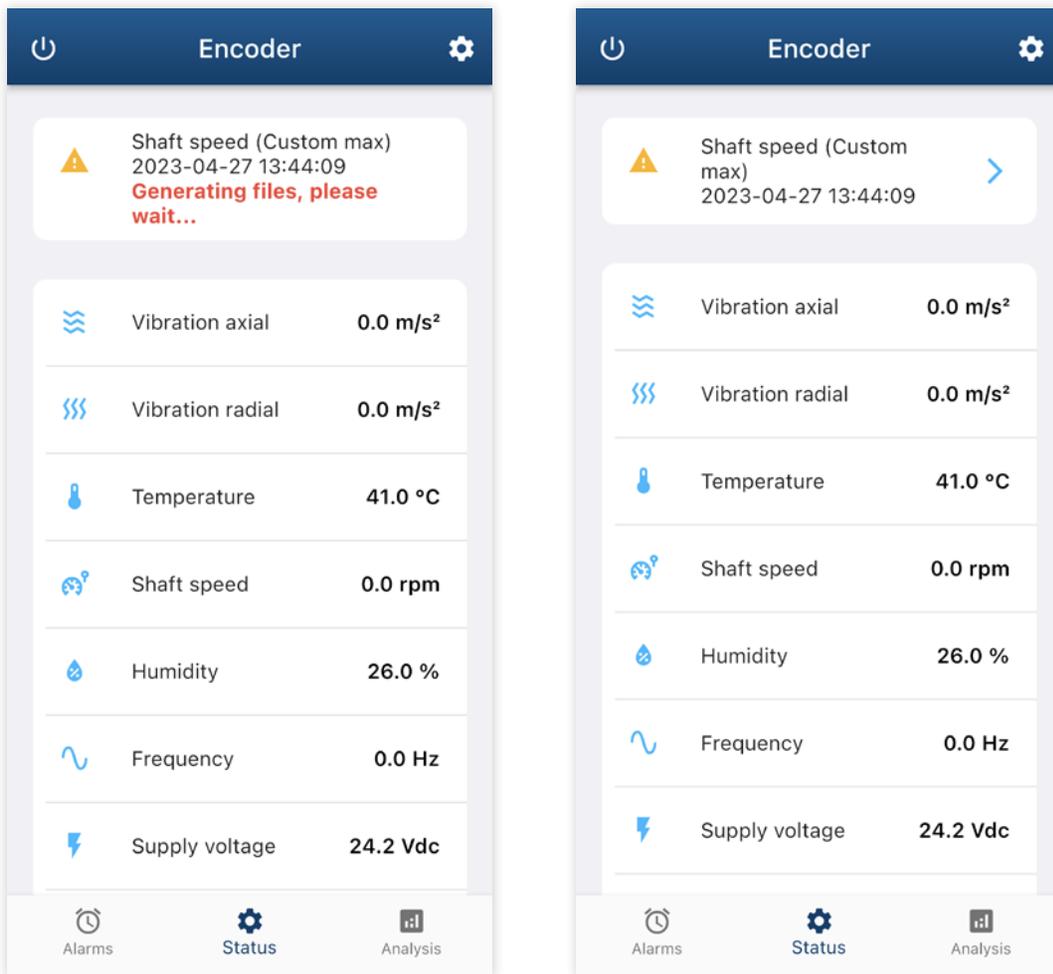


Figure 15 The attention bar may show warnings or notifications

Note: Warnings and alarms related to environmental parameters cannot be acknowledged until 5 minutes after the alarm has occurred.

3.2.10 Alarms

In the Alarms tab you will find all warnings and alarms that have occurred on the encoder over its lifetime.

Under Active alarms you can see all the active warnings/alarms and under acknowledged alarms already acknowledged alarms are visible.

A maximum of 16 acknowledged alarms for each of the below event types are saved.

- User set limits
- Manufacturer set limits
- System errors

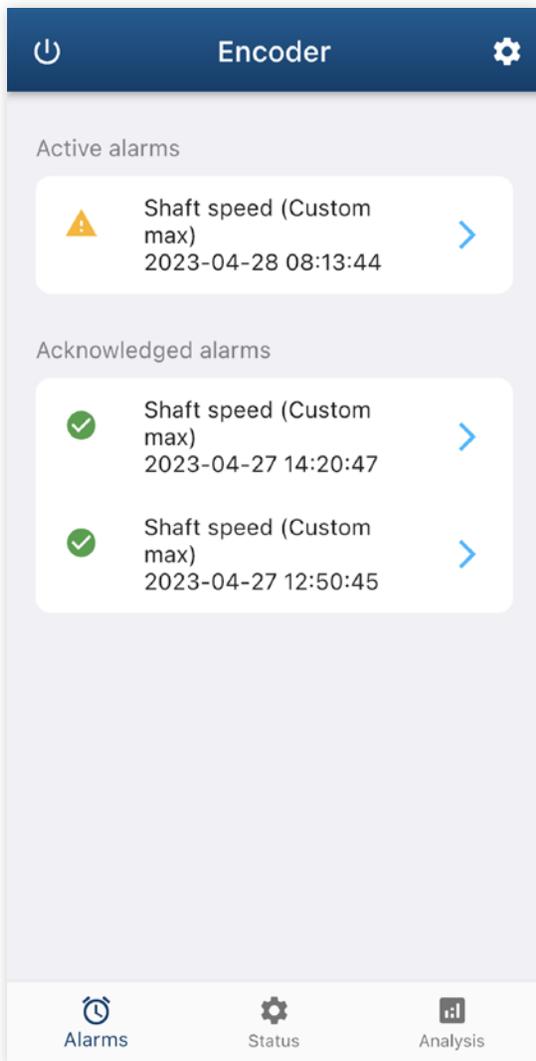


Figure 16 The alarms tab shows current and acknowledged warnings and alarms

Note: Warnings and alarms related to environmental parameters cannot be acknowledged until 5 minutes after the alarm has occurred.

To get more detailed information about an event, tap the event on the screen.

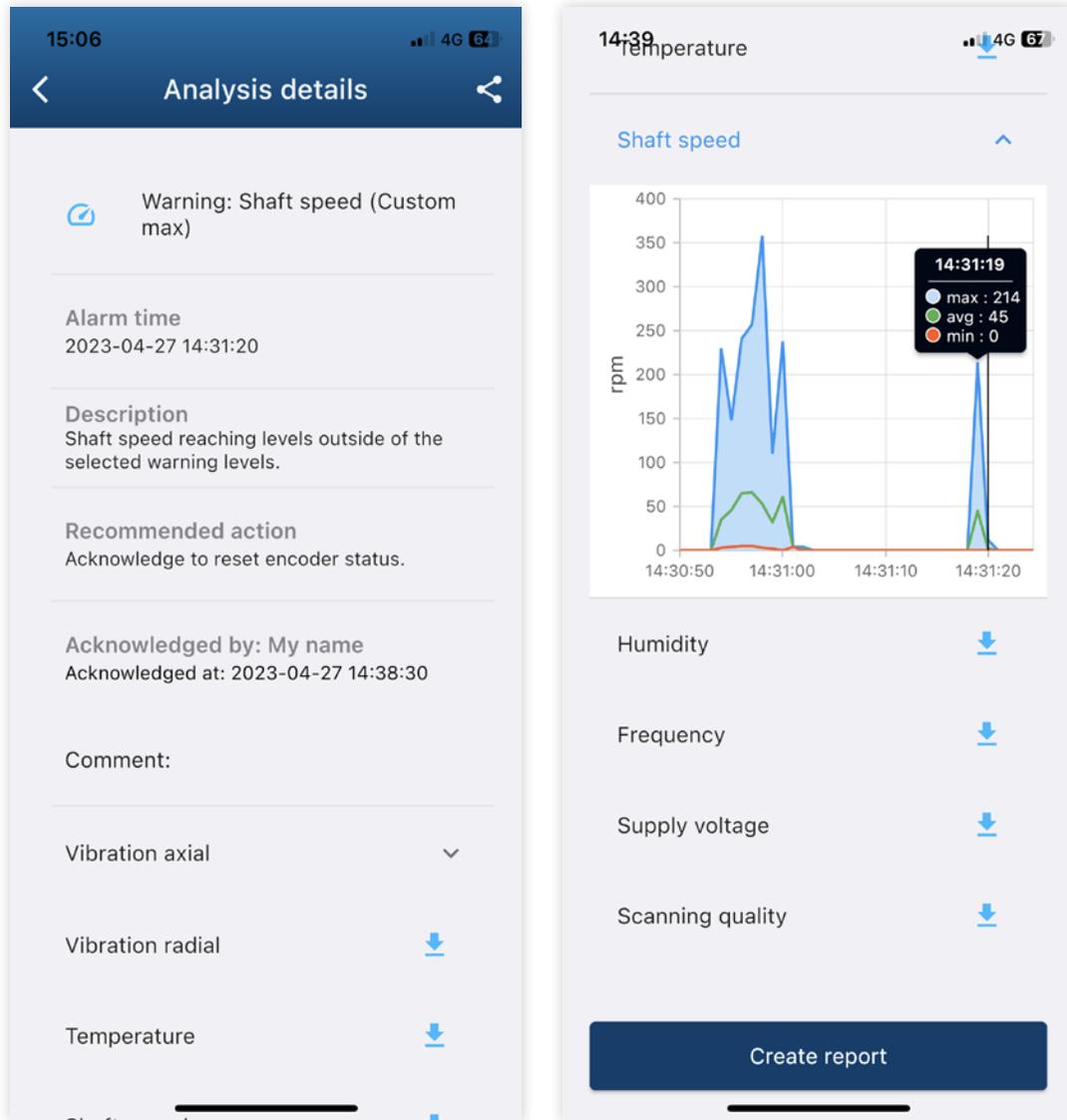


Figure 17 Analysis details

3.2.11 Acknowledge function

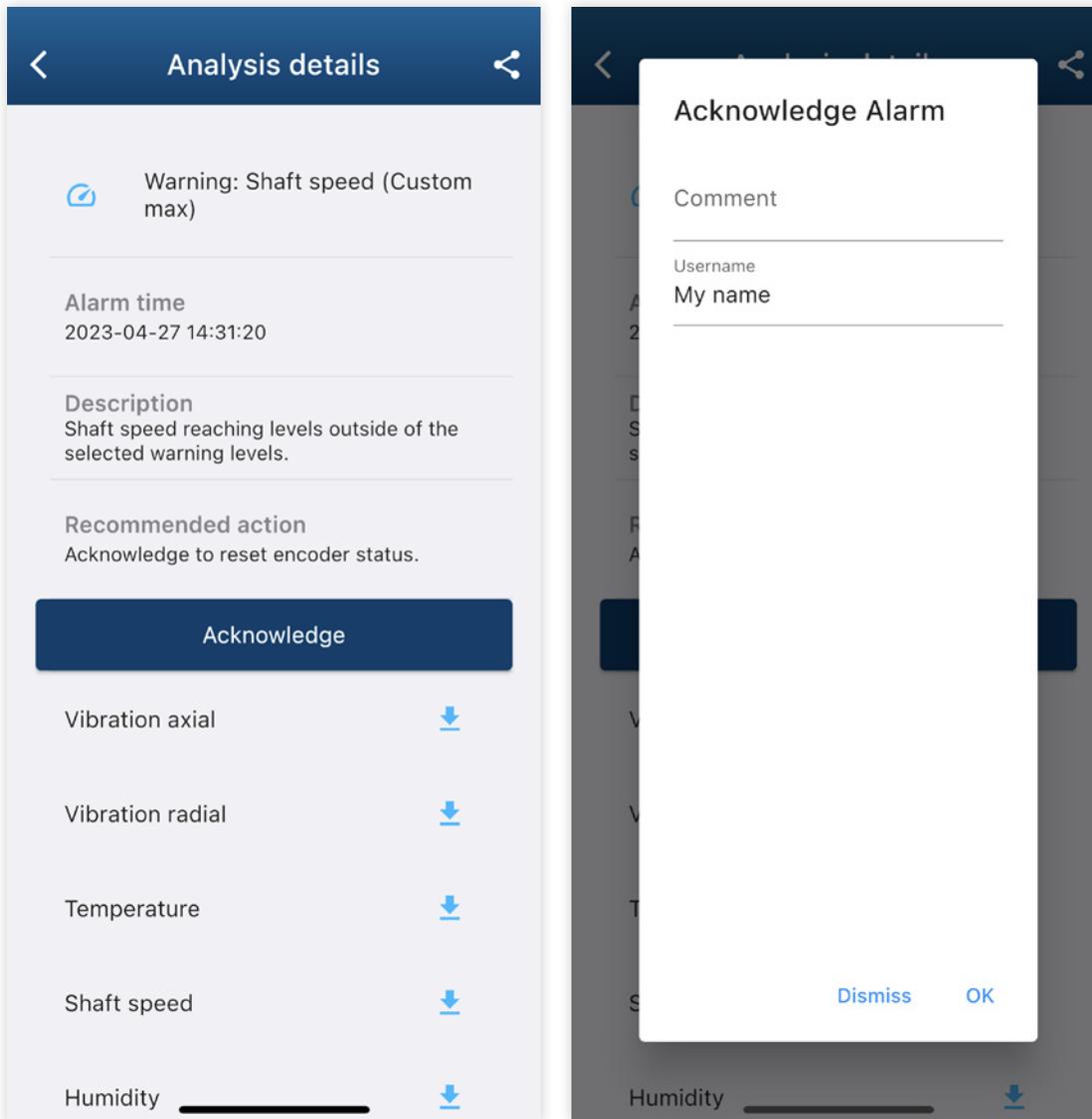


Figure 18 Acknowledge alarm window

The warnings are related to the ambient environment of the encoder, indicating an external problem. If actions are taken in time to change the environment to an acceptable level, the encoder is still operational. Acknowledgement of a warning will therefore reset the encoder status to normal state (steady green). Before acknowledgement of a warning is made, a comment to the event or recommended action can be added for later analysis.

As long as a warning remains unacknowledged the encoder will not send any new warnings of the same type. Other warning types than the unacknowledged one, may however occur. Once a warning is acknowledged, also the same warning type may occur again.

Note: The data cannot be downloaded and the event cannot be acknowledged until 5 minutes after it has occurred. This is to allow the encoder to collect detailed data for a 10 minute window surrounding the event.

3.2.12 Analysis tab

The encoder constantly logs the detailed data of its environment. This data can be used to analyse the environment in which the encoder is used. The analysis may serve to get a better understanding of what the system around the encoder is exposed to. Note that all data is stored in the encoder's internal memory. This means it is possible to connect to the encoder and read out data retrospectively, from the memory. When connected to the encoder, data can be downloaded and saved on the mobile device. Once transferred, downloaded data can be accessed offline.

Data for each ambient parameter will be constantly recorded while the encoder is powered

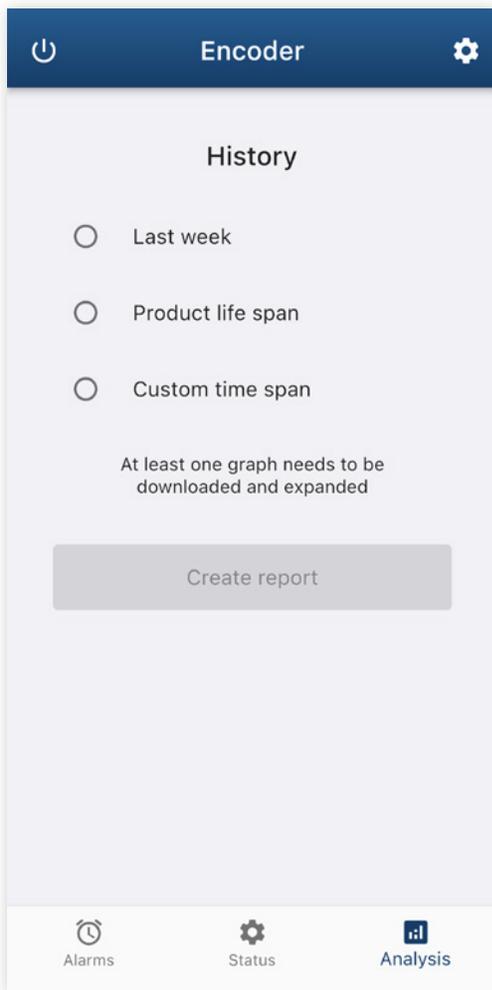


Figure 19 The analysis list tab shows a selection of time spans for analysis

It is possible to view different time ranges depending on the necessary detail of the data. Click on either of the choices to download the data for that choice.

- Last week – stores data for the maximum and minimum values detected for each second within the time range. The graph shows three different lines, one for the maximum values, one for the minimum values detected and one for the average values.
- Product life time – stores data for the maximum and minimum values detected for each hour in the time range. The graph shows three different lines, one for the maximum values, one for the minimum values detected and one for the average values.
- Custom time span – Analyse the data between two points in time. The resolution of the data depends on the chosen time frame. When the time frame is shorter, or more recent, the data is more detailed.

3.2.13 Create PDF from analysis

For each warning that occurs it is possible to download a set of encoder readings from just before and after the event which can then be exported as a .pdf report. The report can be shared via several functions installed on the mobile device. Such as email, Google drive or Dropbox. Click on the download arrows to the right to start the downloading of that data. The graph to be added to the report needs to be expanded to be included in the report. Then click on the Create report button to create the PDF report.

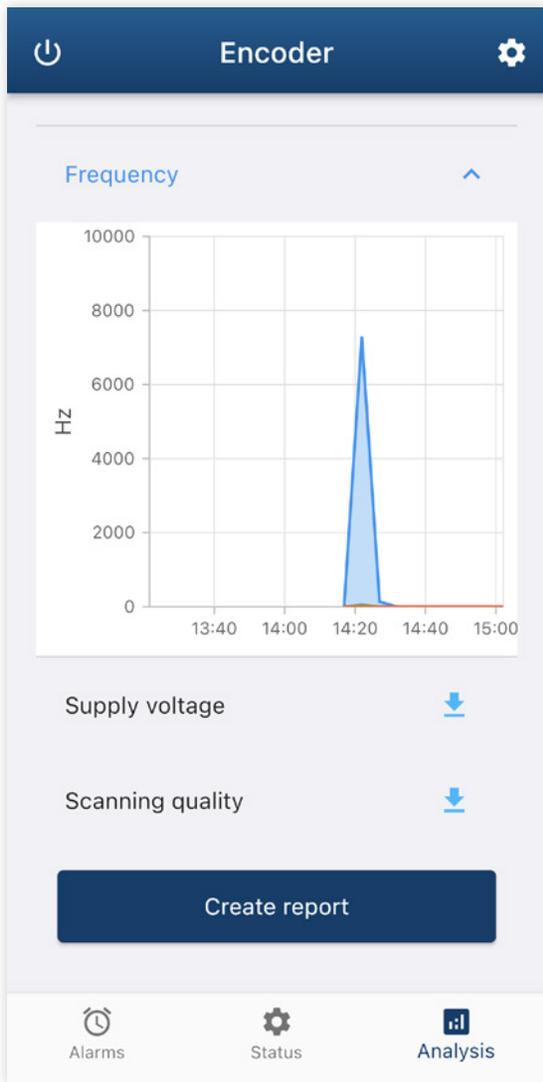


Figure 20 Create and share PDF

4 ADS Uptime integration

4.1 OPC-UA connection via ADS Link

Leine Linde encoders with ADS Uptime can be connected via an ADS Link to enable system integration of the diagnostic data into a system using OPC-UA communication. The interface between the encoder and ADS Link is handled via the power cable, or alternatively, depending on connection interface, via separate RS485 channels. For information about installation and pin configuration, see the mounting instructions and labels of the products.

4.1.1 Status indications of the ADS Link unit

The ADS Link unit has got one LED showing the status of the unit itself, marked “Status link”, and another LED reflecting the status of the connected encoder, marked “Status encoder”. The electrical wires are also used for signalling the encoder status described in chapter 2.3. See table 1 for an overview of status indications from the ADS Link unit.

Status	Status Link	Electrical encoder status		OPC-UA Object
	LED	Wire, Status 1+	Wire, Status 2+	Status value
Normal operation	Steady green	0	1	0
Warning	Steady orange	0/1 (togglng)	1	1
Serious alarm	Flashing red	1	0/1 (togglng)	2
Critical alarm	N/A	1	0	3
Updating	Green/red	1	1	4
Not powered	Off	1	1	-

Table 2 Status indications of the ADS Link unit

The “Status link” LED concerns the status of the ADS Link unit, which can enter the following stages:

Green (Normal operation)

- The ADS Link is connected to an encoder and has a network connection.

Orange (Warning)

- No connection to encoder
- Diagnostic signal quality from encoder is less than 80%
- Internal system warning
- Network not connected

Flashing red (Serious alarm)

- Diagnostic signal quality from encoder is less than 60%
- Internal system error

4.1.2 ADS Link OPC-UA server

The ADS Link functions as an OPC-UA server that provides information about the encoder and its surroundings during operation, and enables two-way communication with an OPC-UA client.

The ADS Link is used together with one ADS Uptime compatible encoder as an attachment device. For the OPC-UA server to start, it is mandatory to have an encoder connected to the ADS Link.

Use table 3 below to localize the OPC-UA server and enable access.

Protocol	Binary
Port	16664
Endpoint URL ADS Link	opc.tcp://<IP ADDRESS>:16664

Table 3 ADS Link OPC-UA server information

4.1.3 IP-settings

The IP address is set dynamically by default, which means that if there is a DHCP server on the network, an IP address will be assigned automatically. ADS Link also have a friendly name (Host name) to be addressed to, *adslink<serial number>.local*. To be able to access the ADS Link via friendly name your device needs to handle multicast DNS.

If no IP address is acquired via DHCP, a link-local address is assigned, chosen randomly among (169.254.x.x).

If there is a DHCP server on the network; login to the router/software providing the DHCP server and find the assigned IP address for the ADS Link. To prevent the IP address from changing upon reboot of the ADS Link, assign a desired static IP from the DHCP server to the ADS Link. This way the ADS Link can keep a dynamic IP address setting.

If the ADS Link will be moved to a different network without a DHCP server, access the ADS Link web server to set a desired static IP address from the ADS Link web interface.

If the ADS Link is connected directly to a PC with Windows 10, or running Bonjour/Avahi software which enables multicast DNS.

- Open command prompt and type:
- “ping adslink<serial number>.local” (example with Link serial number 1234567: “ping adslink1234567.local”)
- After a few seconds delay there should be a response from the Link showing its’ IP address.
- This does not require you to be on the same subnet as the ADS Link. If there is no response, ensure that you have typed the “adslink1234567.local” correctly. If there is still no response, please use a different method of locating the ADS Link.

4.2 Web server

For general settings and overview of the ADS Link there is a web server that can be accessed via a web browser. In order to connect to the ADS Link, it needs to be connected to the same subnet as the computer. To access the web server enter the address of the device in a web browser.

For example:

- <http://192.168.111.1>

4.2.1 Log in

To log in and access your device, click on “Log in”.

Username is “admin” and password is the ADS Link serial number, which can be found on the product label on the side of the product.

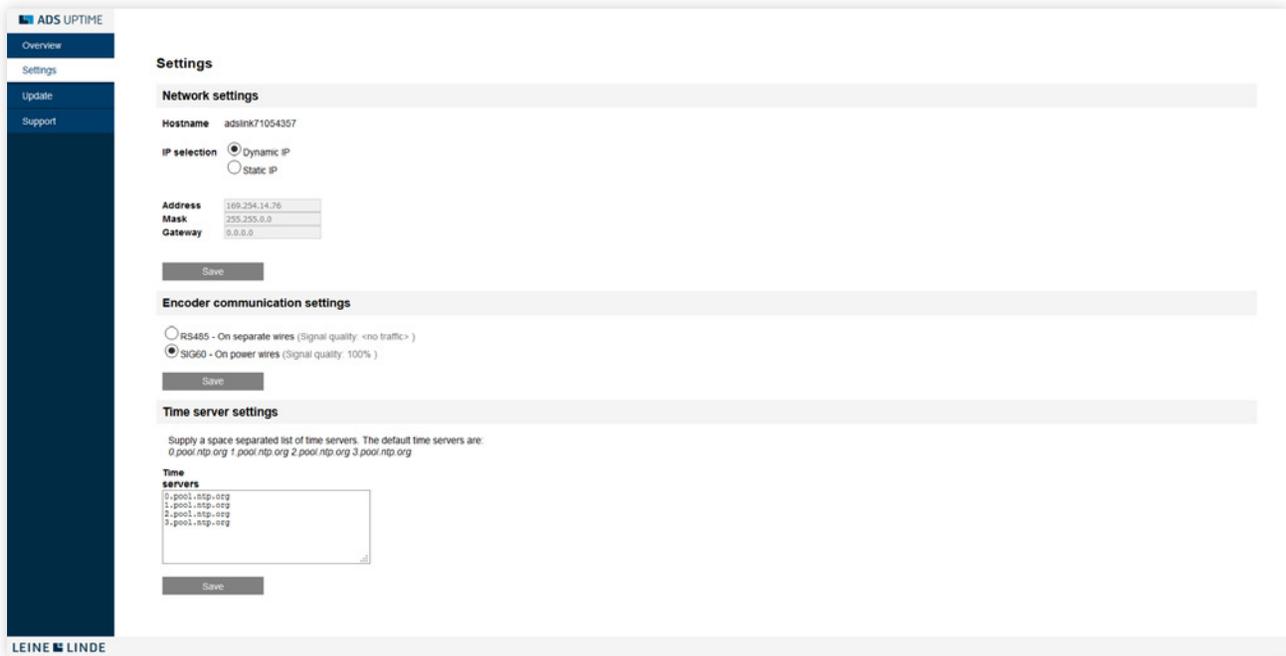


Figure 21 How to access ADS Link in a web browser

4.2.2 Overview

The first tab, “Overview”, is a general description of the connected ADS Link and the attached encoder. Status indication shows in green, “OK”, if the product is powered and connected. For detailed information about the status indication, please see chapter 3.1.3, Status indication for ADS Link unit.

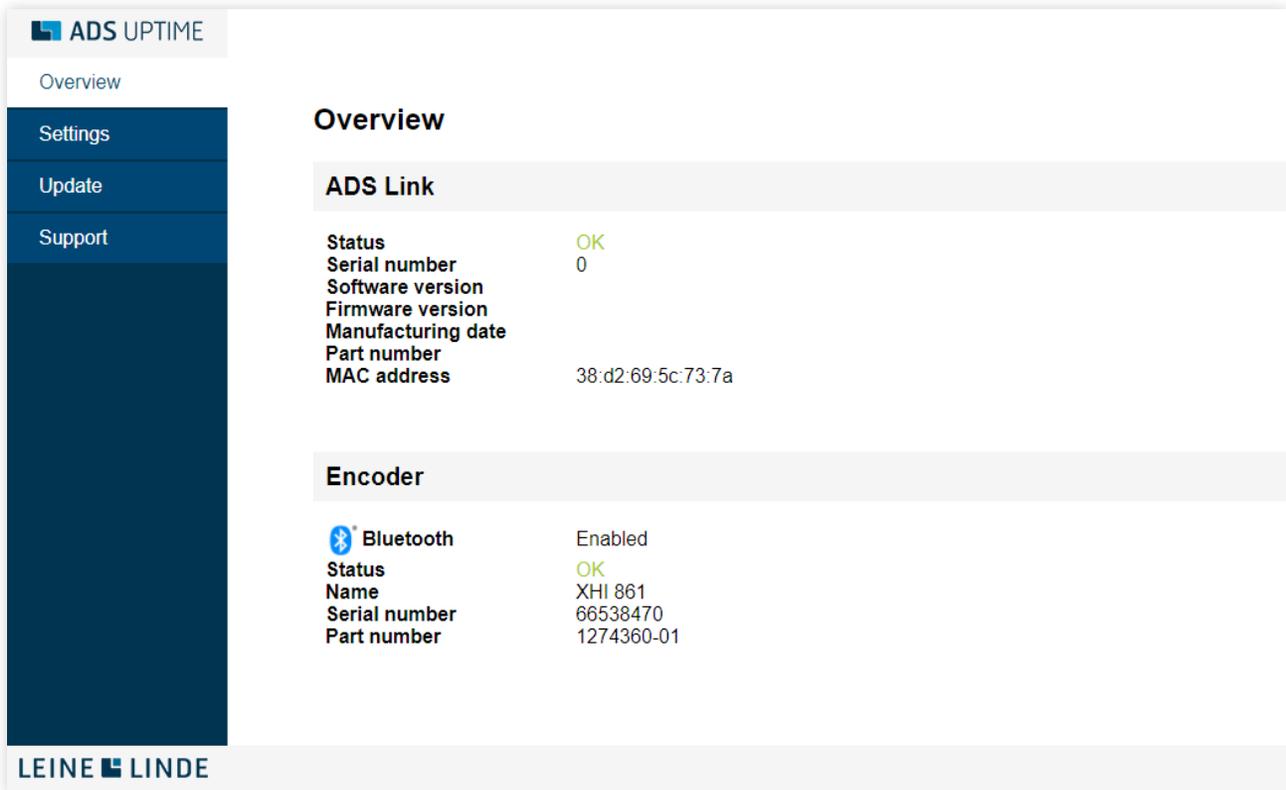


Figure 22 ADS Link web server “Overview” tab

4.2.3 Encoder communication settings

With the web interface the encoder’s network configuration can be reprogrammed. It can be assigned a fixed IP address, subnet mask and gateway. This is performed in the second tab, the “Settings” view.

The encoder communication settings can be manually changed if needed.

- RS485 – Transfers the diagnostic data over separate wires. This configuration can transfer diagnostic data over a longer distance, up to 250 m. Wires need to be connected in accordance with the labels.
- SIG60 – Transfers the diagnostic data over the power cable, which means there is no need for additional wires. This setting can handle a cable length up to 200 m.

ADS Link will use RS-485 if connected, otherwise it will use SIG60.

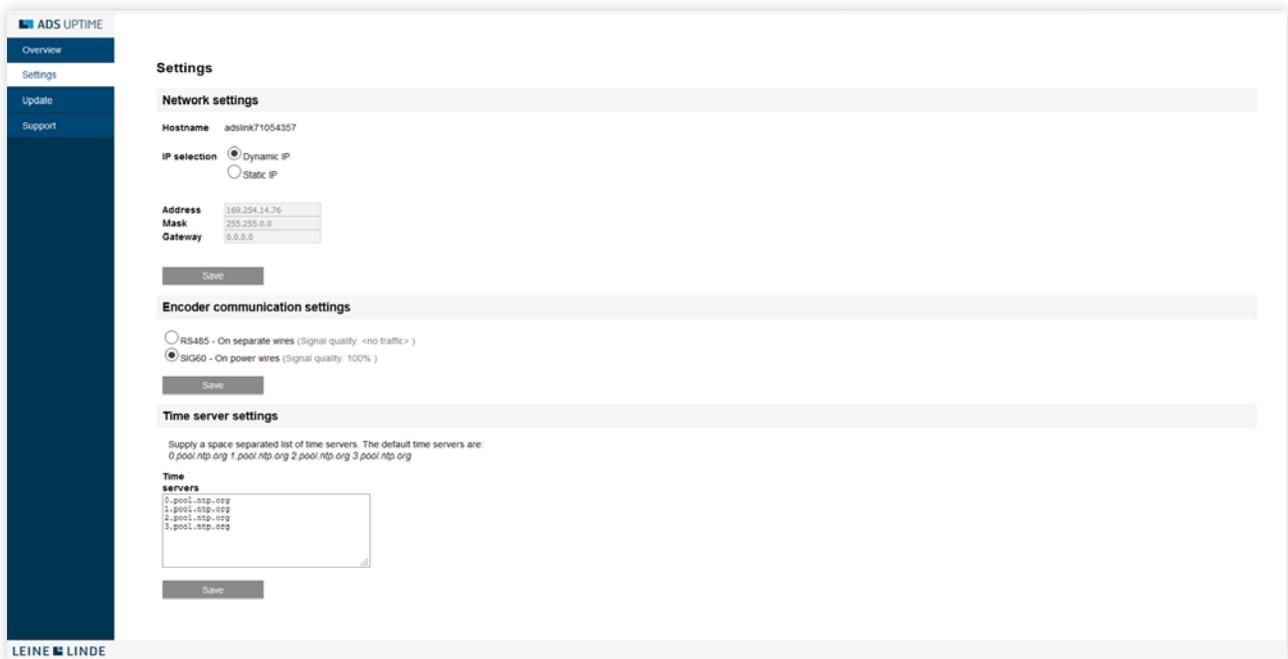


Figure 23 ADS Link web server “Settings” tab

The signal quality reading indicates how good the communication between the ADS Link and the encoder is. If two ADS Links with SIG60 are mounted too close to each other and/or the power supply cables are not properly shielded the signal quality will fall.

Shielding of power supply cables is especially important if ADS Link units are mounted close to each other. If there is interference between 2 adjacent units the signal quality will report “Possible Link crosstalk”. If this is the case, please ensure that the ADS Links are installed according to mounting instructions.

4.2.4 Update

In the third tab, the “Update” view, you can update and/or upgrade your ADS Link and/or the attached encoder.

To update, press “Choose file” to find the file you want to send to the ADS Link or encoder.

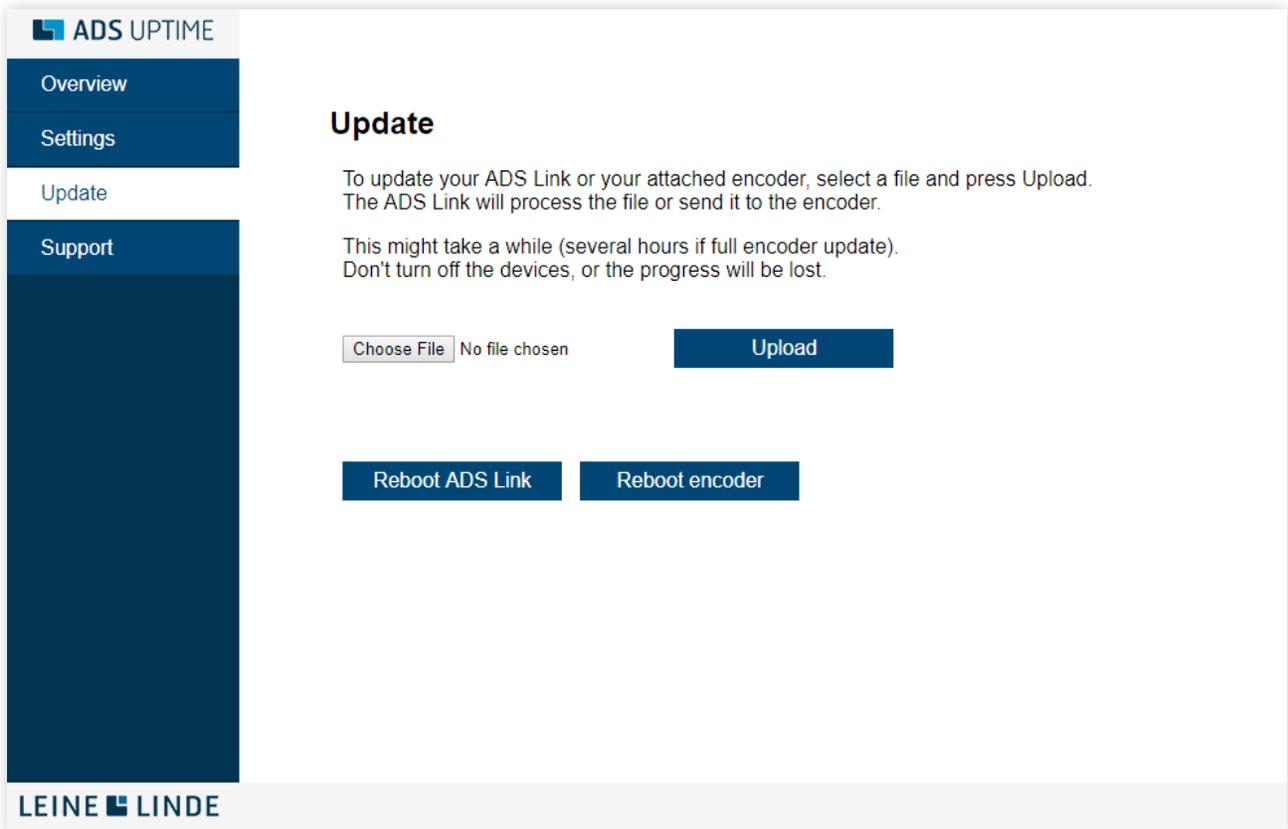


Figure 24 ADS Link web server “Update” tab

When the installation is complete, you need to reboot the updated device to finalize the update.

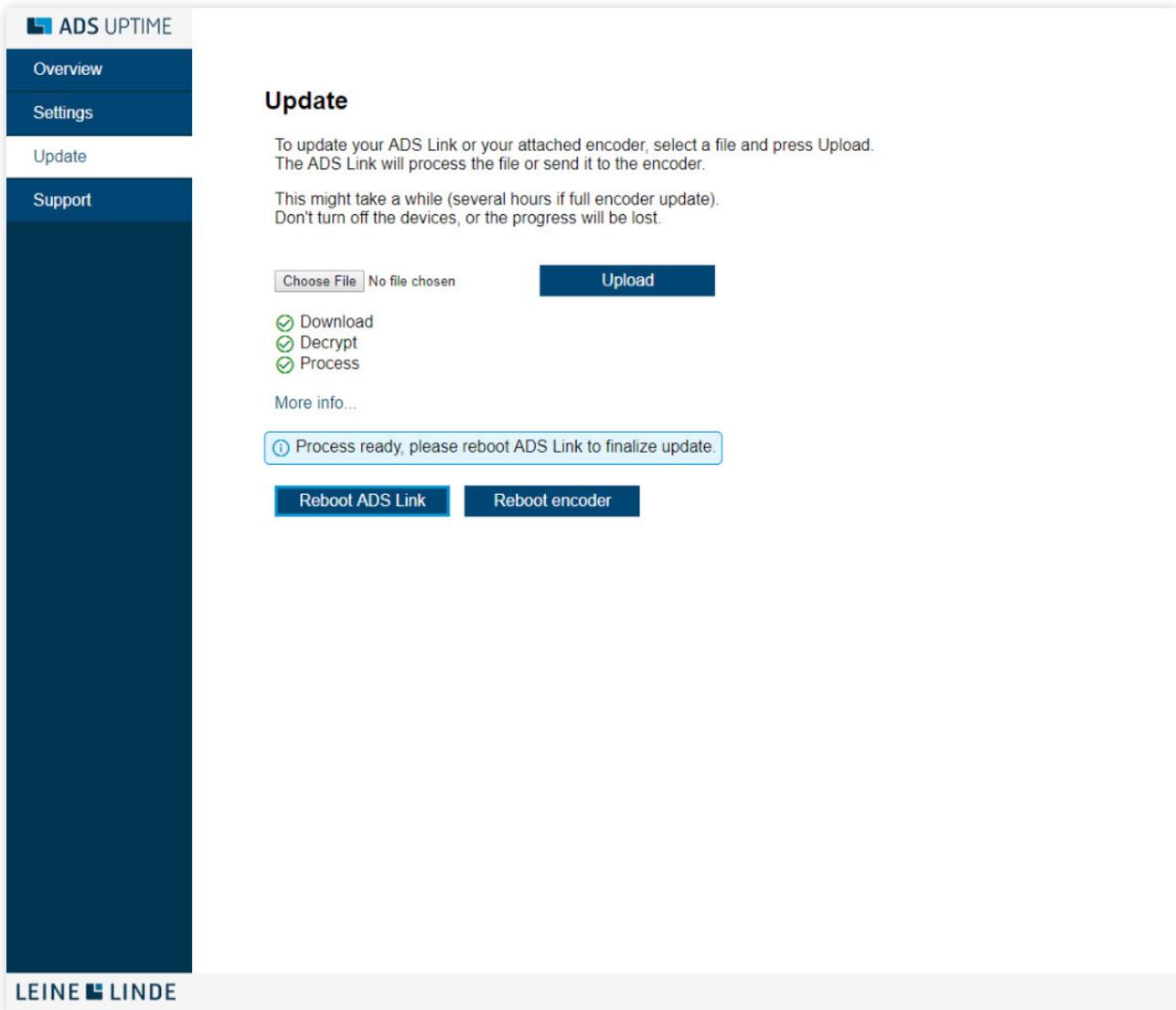


Figure 25 Reboot the updated device for the change to take effect

4.3 OPC-UA configuration example

The following configuration example is made in Unified Automation UaExpert. This client is available for download here:

<https://www.unified-automation.com/downloads/opc-ua-clients.html>

4.3.1 Connect to server

To connect the ADS Link as an OPC-UA server to the OPC-UA client in the system, start by adding the server. Under the headline “Server”, find and click “Add...”. See figure 29.

Note: to be able to connect to the OPC-UA ADS Link server, an ADS Uptime encoder has to be connected to the ADS Link.

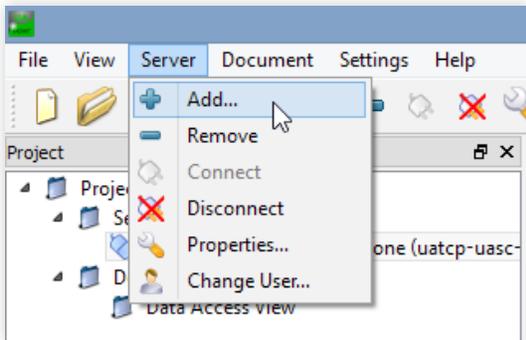


Figure 26 Connect the ADS Link Server

In the window that opens up, double click on the line <Double click to add server> and provide the url for the device you wish to use for the server. See figure 30.

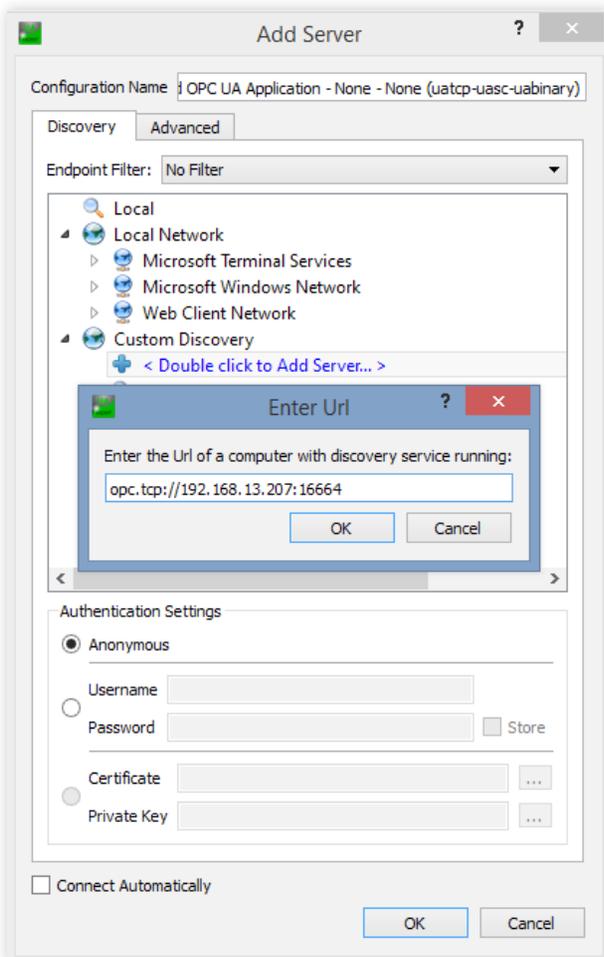


Figure 27 Add server

4.3.2 Parameter overview

When connected to a server (ADS Link), the settings are completed and parameter information can be found in the "Address Space" field. For a complete list of objects containing warnings, alarms, and limit values, see appendix C.

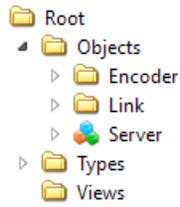


Figure 28 The “Address Space” field in the Unified Automation UaExpert software shows the encoder, link and server as objects

Objects

In the “Encoder” folder all parameters related to the connected encoder can be found. The “Status” parameter reflects the encoder status according to Table 4.

Status	Normal	Warning	Serious alarm	Critical alarm	Updating
Value	0	1	2	3	4

Table 4 The status parameter values in the “Encoder” folder

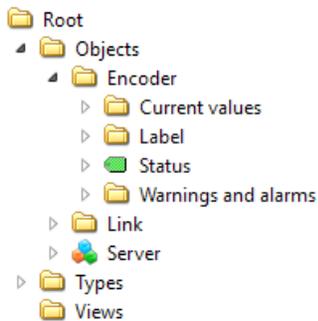


Figure 29 The “Encoder” folder and its contents

In the “Current values” folder all live parameters of the encoder are listed.

Parameter	Unit
Vibration X	m/s ²
Vibration Y	m/s ²
Vibration Z (axial)	m/s ²
Temperature	°C
Shaft speed	rpm
Humidity	% (RH)
Frequency	Hz
Supply voltage	Vdc
Scanning quality	%

Parameter	Unit
Time	UTC
Time powered	s
Time in motion	s
Total revolutions	Count

Table 5 Parameters and units

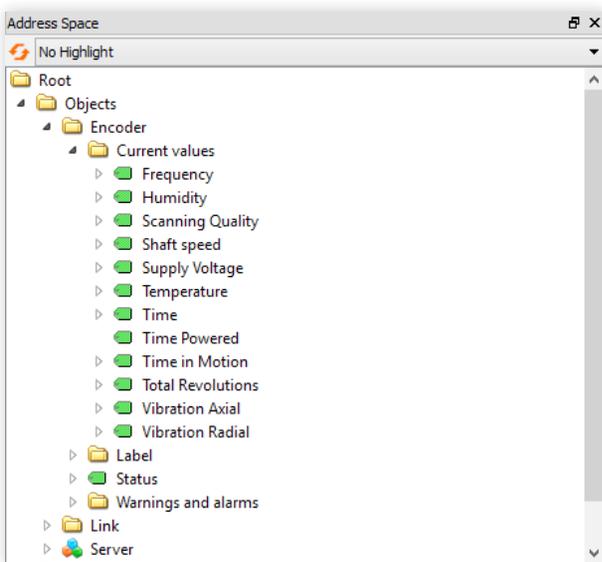


Figure 30 The “Current values” folder with live parameters

In the “Label” folder, all information about the encoder is listed.

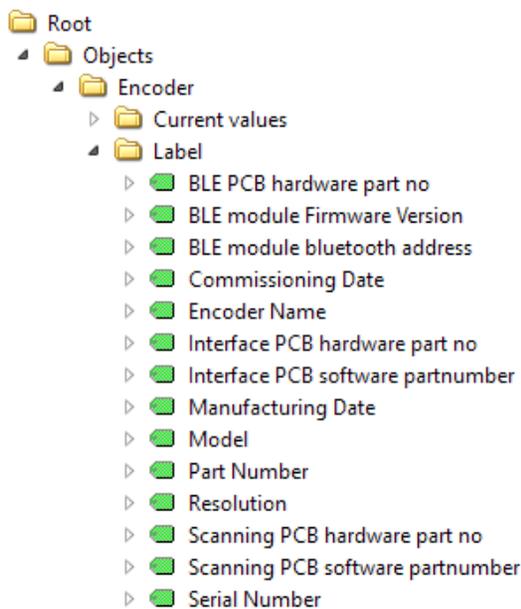


Figure 31 The “Label” folder with contents

4.3.3 Warnings and alarms

In the “Warnings and alarms” folder, all parameters that are related to reading and setting up warnings and alarms are listed. The “Active” parameter shows all active alarms and warnings.

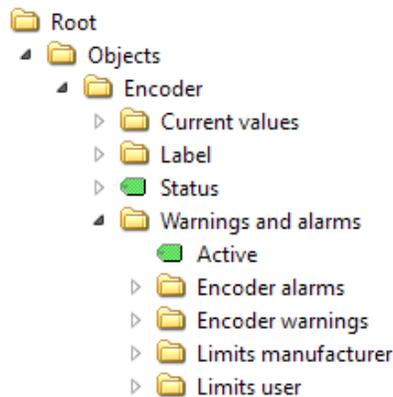


Figure 32 The “Active” parameter can be found in the “Warnings and alarms” folder

In the “Encoder warnings” folder, all warnings that could occur in the encoder are listed. These warnings can be reset by being acknowledged.

In the “Encoder alarms” folder, all alarms that could occur in the encoder are listed.

4.3.4 Limits by manufacturer

In the “Limits manufacturer” folder, all factory-set parameter limits are listed. The environment in which the encoder is operating exposes the encoder to wear. The ambient parameters are harmful to the encoder if their value reaches a level that is outside the encoder’s specifications. This list shows the limit values for each ambient environment parameter. The limit values may be different depending on the exact encoder model. Because these factory-set levels define the range in which the encoder is specified to be operational, the encoder will change its status to a warning state if the ambient parameters go outside the limits. These preset manufacturer limits are always enabled and cannot be reprogrammed.

4.3.5 Warning limits by user

In the “Limits user” folder, all programmable warning levels are listed. In addition to the limits set by manufacturer, the user has the possibility to program their own warning levels. These will not change the factory set levels, but co-exist with them and offer additional levels for warning indication. The programmable levels may for example be used to give warnings at environmental levels that may damage other sensors or components situated close to the encoder or in the same system. The programmable warnings may also be used to indicate overspeed, underspeed or standstill of the shaft. It is also possible to set warning levels for the accumulated values of the operating encoder (generated number of shaft rotations, time in motion, or time powered). It is not possible to set user limits to values outside the manufacturer warning limits. If values are set higher or lower than the manufacturer limits, the user limits will become the manufacturer lower or upper limit.

There are 2 steps to perform in order to activate a user warning. First set the desired limits in the object section “Limits user” to the desired value. Secondly, set the value of desired warning from object section “Encoder warnings” from “-1” to “0”.

The programmable user levels can be changed and the corresponding warnings can be disabled and enabled.

4.3.6 Acknowledge/active/disable warnings

If there is an active warning or alarm the corresponding parameter in the “Warnings and alarms” folder will be set to the value 1. A warning can be acknowledged by writing 0 to the parameter. To prevent the warning from appearing again it can be disabled by writing -1 to the parameter. Otherwise adjust the limit as described in chapter 3.3.5. For a complete list of alarms and warnings, please see appendix C.

Parameter	Disabled	Enabled, status ok	Enabled, status active
Warning xx: description	-1	0	1

Table 6 How to enable, disable or acknowledge a warning

4.3.7 Example of warning

As an example of how to set and handle a warning, choose a parameter under “Limits user”, such as “Temperature max”. To set up your customized warning level, write a value of your choice, for example “25”, to the parameter “Temperature max”, for a warning level at 25 degrees.

Set the value of corresponding “warning 66: user Temperature Max parameter” from -1 to “0”.

When, or if, the encoder exceeds this value, the warning parameter will change status to 1 and the “Active” parameter will show which parameter is active. The “Active” parameter will show a comma delimited list of all currently active warnings and alarms. To acknowledge, set the warning “66: User Temperature Max parameter” to 0 and your encoder will be back in operational mode again, as long as the value stays below the stated limit.

Data Access View					
#	Server	Node Id	Display Name	Value	Datatype
1	ADSLink...	NS1 String Active	Active	{66}	UInt32
2	ADSLink...	NS1 String 0x42_alarm	warning 66:Use...	1	Int16
3	ADSLink...	NS1 String 0x42	User Temperatu...	25	Float

Figure 33 Example of warning

APPENDIX A: Constant function monitoring

The image below, figure 37, shows an overview of the basic encoder functions that are constantly monitored by the diagnostics system. Any deviation from expected functionality will result in a warning or alarm. Detailed description follows in text for each possible error type.

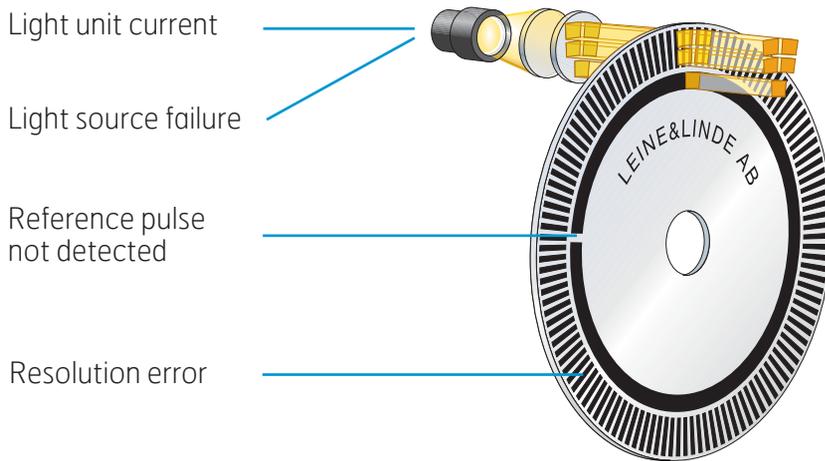


Figure 34

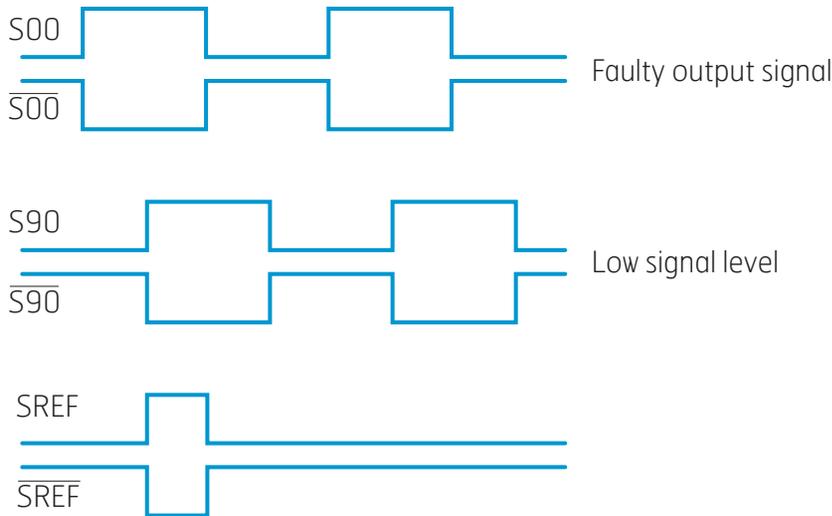


Figure 35 Basic encoder functions

State transition fault

The change of state at channel S00 and S90 is normally changed in accordance with the green arrows, see figure 39 below. The alarm signal is activated if the state is changed in accordance with the red arrows.

Cause: This fault may occur if the encoder is rotated too fast, if the optics are damaged or if the bearings are worn out.

Status: The status indication given by this error is different depending on whether it is a temporary single error or a reoccurring one. Resulting status can be orange, flashing red, or steady red.

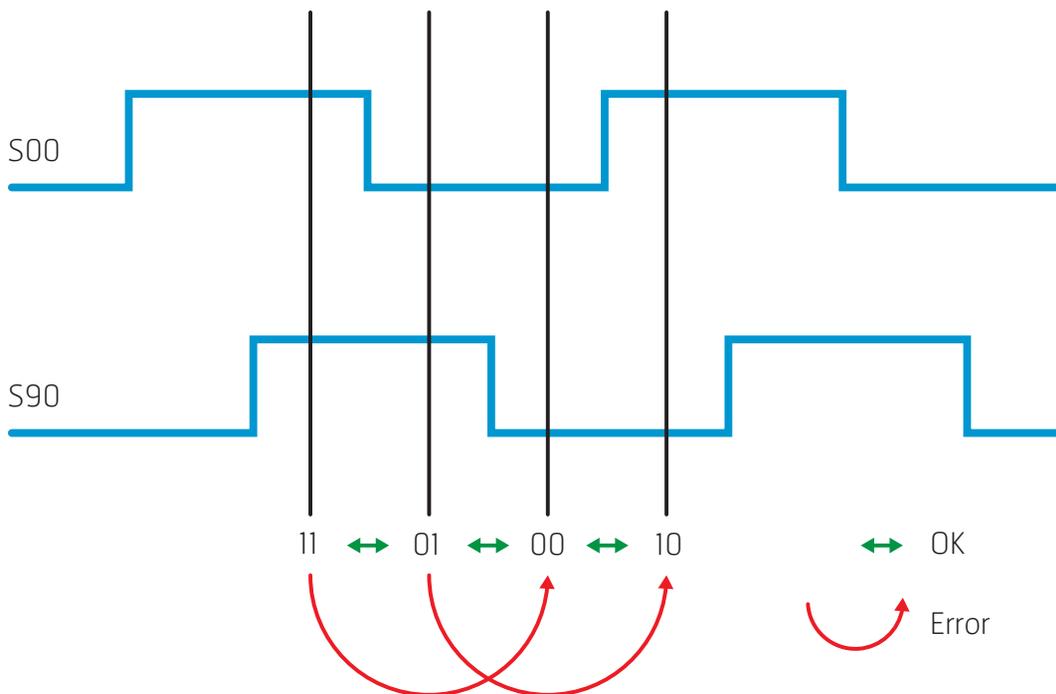


Figure 36 State transition fault

Resolution error

The counted number of pulses in one revolution is different from the expected. All increments between two reference pulses are checked, and the resolution must then be the encoder's resolution or 0. The fault often occurs in conjunction with State transition fault.

Cause: This fault may occur if the optics are faulty or damaged.

Status: The status indication given by this error is different depending on whether it is a temporary single error or a reoccurring one. Resulting status can be orange, flashing red, or steady red.

Reference pulse not detected

This is activated if no reference pulse (Sref) is obtained before the ADS system has counted twice the resolution the encoder shall have. The encoder must be rotated through one additional revolution from the point at which the reference pulse is absent before the fault is activated. This is the case if the encoder is rotated in the direction that was determined for the first counting pulse after the reference pulse. If the direction of rotation is changed so that counting goes towards 0, and if a reference pulse is absent at 0, the alarm signal will be activated directly.

Cause: This fault may occur if the optics or the electronics are damaged or if the bearings are worn out.

Status: The status indication given by this error is different depending on whether it is a temporary single error or a reoccurring one. Resulting status can be orange, flashing red, or steady red.

Light unit current

Monitoring of the remaining reserve of the scanning LED. The light control adjusts the current to the light source to keep a constant amount of light for the photo diodes used to detect the movement of the code disc.

Cause: A low level can result from the following reasons:

- Aging of the LED and the photo elements
- Change in the sensitivity of the photo elements due to temperature
- Change in the light intensity of the LED due to temperature
- Change in the feedback resistance of the input amplifier due to temperature.

This alarm may be triggered from faulty handling of the encoder, for example removal of the encoder back cover while encoder is powered.

If true damage has been done to the encoder the alarm will re-surface after acknowledging this alarm.

Status: This error will result in a flashing red status.

Light source failure

Monitoring of the function of the scanning LED. An alarm is set when the light source has failed and there is no possibility to detect any movement of the code disc.

Cause: This fault occurs if the electronics are damaged or if the connection to the light source is broken.

This alarm may be triggered from faulty handling of the encoder, for example removal of the encoder back cover while encoder is powered.

If true damage has been done to the encoder the alarm will re-surface after acknowledging this alarm.

Status: This error will result in a steady red status.

Faulty output signal for the incremental signals

The incremental signals internally in the encoder are compared with the signals that are sent out on the cable. If these signals do not match, the encoder will operate normally internally, but the signal that is sent out from the encoder will not be correct or will be absent. This error can be detected as long as the encoder speed is within the frequency range 0-200 kHz (0-100 kHz for output HC-HTL).

Cause: This fault occurs if the electronics are damaged, if the encoder outputs are overloaded or short-circuited, or if the ambient temperature is too high.

Status: This error is considered an external one, related to the ambient environment. Resulting status will therefore be orange.

Faulty output signal for the reference pulse

The reference pulse signal internally in the encoder is compared with the signal that is sent out on the cable. If these signals do not match, the encoder will operate normally internally, but the signal that is sent out from the encoder will not be correct or will be absent. This error can be detected as long as the encoder speed is within the frequency range 0-200 kHz (0-100 kHz for output HC-HTL).

Cause: This fault occurs if the electronics are damaged, if the encoder outputs are overloaded or short-circuited, or if the ambient temperature is too high.

Status: This error is considered an external one, related to the ambient environment. Resulting status will therefore be orange.

Low signal level

When too low signal levels are detected from the optics the output gives an error.

Cause: Probable cause of this error is some kind obstruction of the light in the optics.

This alarm may be triggered from faulty handling of the encoder, for example removal of the encoder back cover while encoder is powered.

If true damage has been done to the encoder the alarm will re-surface after acknowledging this alarm.

Status: This error will result in a flashing red status.

ADS system error

Diagnostics system out of order. The incremental signals may be fully functional, but potential errors will not be detected by ADS Uptime. The displayed encoder status is not reliable.

This alarm may be triggered from faulty handling of the encoder, for example removal of the encoder back cover while encoder is powered.

If true damage has been done to the encoder the alarm will re-surface after acknowledging this alarm.

Status: This error will result in a flashing red status.

Scanning quality

The encoder scanning quality is constantly monitored for signs that the scanning is deteriorating as a result of wear and age. A manufacturer alarm is triggered at the threshold limit 10% scanning quality. If the value 10% is reached, consider planning for an encoder replacement.

If the scanning quality drops the compensation current to the scanning LED is increasing. Each encoder is calibrated after manufacturing to ensure that the 10% scanning quality mark represents the threshold of acceptable inputs to the scanning LED.

This alarm may be triggered from faulty handling of the encoder, for example removal of the encoder back cover while encoder is powered.

If true damage has been done to the encoder the alarm will re-surface after acknowledging this alarm.

APPENDIX B: Monitoring of ambient environmental parameters

All ambient environmental parameters are sampled with an interval of 0,1 second. In order to generate a warning, the actual environment must however exceed the permitted level during a time period of at least 1 second.

Vibration

After re-orienting the encoder the vibration values will give a false vibration reading for a brief period. After 20-30 seconds the sensors will compensate for the new orientation by subtracting the gravitational pull.

Radial

The radial vibration is defined as the amplitude for the resulting force of acceleration in two dimensions, X and Y axis. It is sampled at a frequency of 3,2 kHz and presented as the RMS value, the root mean square value, for the last 1 second. This means that continuous vibration is detected and that instant shocks are filtered out.

Axial

The axial vibration is defined as the amplitude for the resulting force of acceleration Z axis. It is sampled at a frequency of 3,2 kHz but is presented as the RMS value during the last 1 second. This means that continuous vibration is detected and that instant shocks are filtered out.

The preset warning level is set with the purpose of preventing the encoder from detrimental vibration levels. The preset warning is given at 150 m/s².

The vibration level can also be used as an indication of commissioning quality. The better the quality of the installation the longer operating life can be expected from the encoder bearings. An installation of good quality usually has continuous vibrations below 5 m/s², but the values depend on several factors in every unique application, for example on the actual shaft speed. The programmable warning levels may be used to indicate if the commissioning quality is good enough for continuous use in the actual application.

Shaft speed

The speed of the rotating encoder shaft is expressed in revolutions per minute (unit rpm). The preset warning level is set to 6000 rpm.

Frequency

The electrical frequency is defined as incremental pulses per second (unit Hertz). The preset level is 100 kHz for HCHTL output and 200 kHz for HTL and RS422, but the recommended frequency may be limited by the length of the transmission cable in use.

Temperature

The encoder's operating temperature is detected within the range -60°C to +195°C. The monitored temperature is measured on the encoder PCB, which is approximately +20 °C above the ambient temperature when the encoder is in operation. Heat is generated by the encoder's electronics as well as by the friction of the rotating bearings.

The warning level is set to +100°C which is the maximum internal temperature for which the encoder has been verified.

Supply voltage

The displayed supply voltage shows what voltage is supplied to the encoder. This gives the real voltage level at the encoder end of the cable, after potential voltage drops in the supply cable.

Depending on the exact model, the encoder is specified for operation within the range of 9-30 Vdc.

APPENDIX C: Warnings, limits and alarms

These tables represent the latest versions of encoder and App.

Encoder warnings

ID	Read/Write	User/Manufacturer	Warning type	Use	Status LED indication
33	RW	Manufacturer	Temperature Min	0: Enabled/Reset 1: Active	Amber
34	RW	Manufacturer	Temperature Max	0: Enabled/Reset 1: Active	Amber
35	RW	Manufacturer	Humidity max	0: Enabled/Reset 1: Active	Amber
38	RW	Manufacturer	Vibration axial Max	0: Enabled/Reset 1: Active	Amber
39	RW	Manufacturer	Vibration radial Max	0: Enabled/Reset 1: Active	Amber
42	RW	Manufacturer	Frequency Max	0: Enabled/Reset 1: Active	Amber
44	RW	Manufacturer	Shaft speed Max	0: Enabled/Reset 1: Active	Amber
45	RW	Manufacturer	Supply voltage Min	0: Enabled/Reset 1: Active	Amber
46	RW	Manufacturer	Supply voltage Max	0: Enabled/Reset 1: Active	Amber
65	RW	User	Temperature Min	-1: Disabled 0: Enabled/Reset 1: Active	Amber
66	RW	User	Temperature Max	-1: Disabled 0: Enabled/Reset 1: Active	Amber
67	RW	User	Humidity Max	-1: Disabled 0: Enabled/Reset 1: Active	Amber
70	RW	User	Vibration axial Max	-1: Disabled 0: Enabled/Reset 1: Active	Amber
71	RW	User	Vibration radial Max	-1: Disabled 0: Enabled/Reset 1: Active	Amber
73	RW	User	Frequency Min	-1: Disabled 0: Enabled/Reset 1: Active	Amber

ID	Read/Write	User/Manufacturer	Warning type	Use	Status LED indication
74	RW	User	Frequency Max	-1: Disabled 0: Enabled/Reset 1: Active	Amber
75	RW	User	Shaft speed Min	-1: Disabled 0: Enabled/Reset 1: Active	Amber
76	RW	User	Shaft speed Max	-1: Disabled 0: Enabled/Reset 1: Active	Amber
77	RW	User	Supply voltage Min	-1: Disabled 0: Enabled/Reset 1: Active	Amber
78	RW	User	Supply voltage Max	-1: Disabled 0: Enabled/Reset 1: Active	Amber
79	RW	User	Time powered Max	-1: Disabled 0: Enabled/Reset 1: Active	Amber
80	RW	User	Time in motion Max	-1: Disabled 0: Enabled/Reset 1: Active	Amber
81	RW	User	Total revolutions Max	-1: Disabled 0: Enabled/Reset 1: Active	Amber
82	RW	User	Scanning quality Min	-1: Disabled 0: Enabled/Reset 1: Active	Amber
768	RW	System	System error	0: Enabled/Reset 1: Active	Blinking red

Table 7 Encoder warnings

Limits

ID	Read/Write	User/Manufacturer	Limit type	Use	Units	Status LED indication
33	R	Manufacturer	Temperature Min	Minimum temperature before risking damage to encoder.	°C	Amber
34	R	Manufacturer	Temperature Max	Maximum temperature before risking damage to encoder.	°C	Amber
35	R	Manufacturer	Humidity Max	The maximum tolerated humidity before encoder risks damage.	%	Amber
38	R	Manufacturer	Vibration Axial Max	Maximum tolerated axial vibration before risking damage to encoder.	m/s ²	Amber
39	R	Manufacturer	Vibration Radial Max	Maximum tolerated radial vibration before risking damage to encoder.	m/s ²	Amber
42	R	Manufacturer	Frequency Max	Displays manufacturer maximum frequency limits before compromising the output signal.	Hz	Amber
44	R	Manufacturer	Shaft speed Max	Maximum encoder rotational speed [RPM] before risking damage to encoder.	RPM	Amber
45	R	Manufacturer	Supply voltage Min	Minimum supply voltage before risking damage to encoder.	V	Amber
46	R	Manufacturer	Supply voltage Max	Maximum supply voltage before risking damage to encoder.	V	Amber
50	R	Manufacturer	Scanning quality Min	Minimum permissible scanning quality before encoder is near end of life.	%	Flashing Red
65	R/W	User	Temperature Min	Set lower limit temperature for which to activate encoder warning "66".	°C	Amber
66	R/W	User	Temperature Max	Set upper limit temperature for which to activate encoder warning "66".	°C	Amber
67	R/W	User	Humidity Max	Set upper limit relative humidity for which to activate encoder warning "67".	%	Amber

ID	Read/Write	User/Manufacturer	Limit type	Use	Units	Status LED indication
70	R/W	User	Vibrations axial Max	Set an axial vibration level to become aware if the vibration characteristics of the motor setup changes over time.	m/s ²	Amber
71	R/W	User	Vibrations radial Max	Set a radial vibration level to become aware if the vibration characteristics of the motor setup changes over time.	m/s ²	Amber
73	R/W	User	Frequency Min	Underspeed. Set lower limit frequency before activating encoder warning "73".	Hz	Amber
74	R/W	User	Frequency Max	Overspeed. Set upper limit frequency before activating encoder warning "74".	Hz	Amber
75	R/W	User	Shaft Speed Min	Underspeed. Set rpm value for when to activate encoder warning "75".	RPM	Amber
76	R/W	User	Shaft speed Max	Overspeed. Set rpm value for when to activate encoder warning "76".	RPM	Amber
77	R/W	User	Supply voltage Min	Set lower limit voltage for which to activate warning "77".	V	Amber
78	R/W	User	Supply voltage Max	Set upper limit voltage for which to activate encoder warning "78".	V	Amber
79	R/W	User	Time powered Max	Use as a time limit to schedule encoder for maintenance.	Hours	Amber
80	R/W	User	Time in Motion Max	Set a time in motion limit to schedule encoder for maintenance.	Hours	Amber
81	R/W	User	Total revolutions Max	Set an upper number of revolutions to schedule encoder for maintenance.	revolutions	Amber
82	R/W	User	Scanning quality Min	Set lower limit scanning quality for when to activate encoder warning "82".	%	Amber

Table 8 Limits

Encoder alarms

ID	Acknowledge	Definition	Detailed description	Recommeneded action	Status LED indication
768	Yes	ADS system error	Diagnostics system out of order. The incremental signals may be fully functional, but potential errors will not be detected by ADS Uptime. The displayed encoder status is not reliable.	If alarm is recurring after acknowledge: Replace encoder at next maintenance stop to ensure ADS functionality.	
50	Yes	Scanning quality Min	The scanning quality is below the preset warning level. The scanning LED is starting to get worn out.	Acknowledge to reset the encoder status, if the alarm reoccurs the encoder is damaged and needs to be replaced.	Flashing Red
515	Yes	LightSource-Failure	Light source, no encoder functionality.	If the alarm reoccurs after being acknowledged the encoder is damaged and needs to be replaced.	Steady Red
516	Yes	Faulty output signal (S00)	Faulty output signal for the incremental pulses, due to electrical interference. Risk of temporary encoder malfunction.	Check your installation and take necessary measures to solve the problem. Then acknowledge to reset encoder status.	Amber
517	Yes	Faulty output signal (S00\)	Faulty output signal for the incremental pulses, due to electrical interference. Risk of temporary encoder malfunction.	Check your installation and take necessary measures to solve the problem. Then acknowledge to reset encoder status.	Amber
518	Yes	Faulty output signal (S90)	Faulty output signal for the incremental pulses, due to electrical interference. Risk of temporary encoder malfunction.	Check your installation and take necessary measures to solve the problem. Then acknowledge to reset encoder status.	Amber
519	Yes	Faulty output signal (S90\)	Faulty output signal for the incremental pulses, due to electrical interference. Risk of temporary encoder malfunction.	Check your installation and take necessary measures to solve the problem. Then acknowledge to reset encoder status.	Amber
520	Yes	Faulty output signal (Sref)	Faulty output signal for the incremental pulses, due to electrical interference. Risk of temporary encoder malfunction.	Check your installation and take necessary measures to solve the problem. Then acknowledge to reset encoder status.	Amber

ID	Acknowledge	Definition	Detailed description	Reccomended action	Status LED indication
521	Yes	Faulty output signal (Sref)	Faulty output signal for the incremental pulses, due to electrical interference. Risk of temporary encoder malfunction.	Check your installation and take necessary measures to solve the problem. Then acknowledge to reset encoder status.	Amber
522	Yes	Low signal level	Encoder is getting worn out.	Replace encoder at next maintenance stop.	Flashing Red
523	Yes	ThermalprotectionInc (linedriver)	Encoder error (thermal protection inc).	Check your supply voltage source and take necessary measures to solve the problem. Then acknowledge to reset encoder status.	Amber
524	Yes	ThermalprotectionIncInv (linedriver)	Encoder error (thermal protection inc Inv).	Check your supply voltage source and take necessary measures to solve the problem. Then acknowledge to reset encoder status.	Amber
525	Yes	StateTransitionFault	Encoder warning (state transition fault)	Acknowledge to reset encoder status.	Amber
526	Yes	StateTransitionFault	Encoder error (state transition fault).	If the alarm reoccurs after being acknowledged the encoder is damaged and needs to be replaced.	Steady Red
527	Yes	Reference pulse missing	Encoder warning (reference pulse missing).	Acknowledge to reset encoder status.	Amber
528	Yes	Reference pulse missing	Encoder error (reference pulse missing).	If the alarm reoccurs after being acknowledged the encoder is damaged and needs to be replaced.	Steady Red
529	Yes	ResolutionError	Encoder warning (resolution error)	Acknowledge to reset encoder status.	Amber
530	Yes	ResolutionError	Encoder error (resolution error)	If the alarm reoccurs after being acknowledged the encoder is damaged and needs to be replaced.	Steady Red

Table 9 Encoder alarms



The best encoders and sensors are those you never have to think about. Those that simply do their job – year after year. Leine Linde develops and manufactures customized encoder and sensor solutions for demanding environments, advanced measuring systems for accurate feedback of speed, position or strain.

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